TEA MUSELIANI [1,2], MARINE NIKOLAISHVILI [1,3], GOGI JIKIA[1,2],
KHATUNA DONDOLADZE [1,2], DAVIT NATADZE [1]

EFFECT OF ELECTROMAGNETIC FIELD ON THE WEIGHT, NUMBER AND DEVELOPMENT OF OFFSPRING OF IRRADIATED PREGNANT RATS

[1]Ivane Beritashvili Center of Experimental Biomedicine, [2]European University,
[3]Grigol Robakidze University

Doi: https://doi.org/10.52340/jecm.2023.01.20

თეა მუსელიანი [1,2], მარინე ნიკოლაიშვილი [1,3], გოგი ჯიქია [1],
ხათუნა დონდოლაძე [1,2], დავით ნათაძე[1]

ელექტრომაგნიტური ველის ეფექტი დასხივებული მაკე ვირთაგვების ნაშიერის წონაზე, რიცხობრიობასა და განვითარებაზე

[1]ი. ბერიტაშვილის ექსპერიმენტული ბიომედიცინის ცენტრი, [2]ევროპის უნივერსიტეტი, [3]გრიგოლ რობაქიძის უნივერსიტეტი

რეზიუმე

მობილური ტელეფონის გამოსხივება იწვევს მნიშვნელოვან ცვლილებებს ცოცხალ ორგანიზმებში. მაკეობის დროს ვირთაგვების დასხივებამ ელექტრომაგნიტური ველით აჩვენა, რომ ზრდის ჰორმონი 2-ის (GH2) კონცენტრაცია მცირდება და ეს იწვევს ემბრიონის წონის შემცირებას, მის განვითარების ჩამორჩენას, კერძოდ, კიდურების და კუდის სიგრძის შემცირებას დასხივებული ვირთაგვების ნაშიერში კონტროლთან შედარებით, შესაბამისად, ნაკლები წონა ექსპერიმენტული ჯგუფის ნაშიერში. საზოგადოებამ, განსაკუთრებით ორსულებმა, უნდა იცოდეს, რომ ელექტრომაგნიტური ველი უარყოფითად მოქმედებს არამარტო მათ ჯანმრთელობაზე, არამედ ნაყოფზეც, რაც იწვევს გარკვეულ ცვლილებებს.

Introduction: Mobile phones are one of the most popular and fast-growing technological achievements that are necessary and important in our modern life. The widespread use of cell/mobile phones in recent years has caused concern among scientists as electromagnetic radiation causes significant changes in the living organism. Scientists in many countries are trying to determine the effect of electromagnetic radiation emitted from mobile phones, which has grown rapidly over the last two decades. The use of wireless technologies such as wireless (Wi-Fi) communication devices in homes, workplaces, public places, schools, etc. has also increased significantly in recent years. The rapid development of wireless technologies has steadily increased the level of electromagnetic field (EMF) in the environment.

Public and scientific awareness, previously focused on studying the harmful effects of EMF radiation from mobile phones, has now shifted to the biological hazards of wireless equipment. The Council of Europe recommends that the use of mobile phones and the Internet be restricted in all schools on the continent to protect young children from potentially harmful radiation [1,7].

Pregnant women and children belong to the most sensitive groups of population, and are particularly vulnerable to electromagnetic field radiation. The central nervous system (CNS) is considered to be potentially one of the most sensitive tissues and organs that continues to develop in childhood. The researchers found that cell phone radiation exposure during the incubation period of chicken eggs caused a detrimental effect on growth and development [6].

Electromagnetic radiation can damage the placental barrier. The membrane impedes the metabolism in the blood between mother and fetus, which proves that a pregnant woman should use a mobile phone only in case of emergency. Recent studies have shown that the intensive use of mobile phones by pregnant women increases the risk of miscarriage, congenital anomalies and behavioral problems in children [8].

The effect of the electromagnetic field on growth hormone 2 is the same as on placental growth hormone, which is produced and secreted in the syncytiotrophoblast layer of the placenta during pregnancy and during this period becomes the predominant form of growth hormone (GH) in the body,

different from pituitary growth hormone with 13 amino acids and has the ability to glycosylate. This hormone is an example of a trophoblastic hormone that promotes the mother's metabolic adaptation to pregnancy. Low concentration of the hormone in the mother's body slows down the development of the embryo. It is known from the literature that GH2, in combination with the hormone prolactin, stimulates the production of insulin-like growth factor and modulates maternal intermediate metabolism, resulting in an increase in glucose and amino acid concentrations in the fetus [4,5].

Therefore, we decided to study the concentration of growth hormone 2 (GH-2) in pregnant rats exposed to electromagnetic field, what the effect of electromagnetic field as a negative stimulus on offspring weight, number and development would be.

Materials and methods:

- Wistar adult female mice were used for the experiment, which we divided into two groups (n=10 / in each group). After cross-breeding of animals, the presence of vaginal plugs and sperm in the vaginal smear, which we observed under a microscope, was considered an indicator of the first day of pregnancy [2].
- Electromagnetic field generation system: The experimental group was placed under an electromagnetic field in 80/80/30 plastic cages, an electromagnetic field generator was installed with a GSM system mobile phone, network frequency (1800 MG / H), placed 5 mm high in the center of the cage [3]. We measured the electromagnetic field with a special device - "Cornet microsystem, elecrtosmog meter", the frequency of the phone at the time of the phone call was 1900 Hz, a special program allows you to make a call every 10 minutes (sound and vibration are off). The duration of the call was 10, seconds the exposure to the electromagnetic field was only 12 hours per day for the entire gestation period, while the control group rats were in the same conditions but without exposure to the EMF in another room.
- GH-2 was determined during the last week of pregnancy in both experimental and control groups. Blood samples were taken from the tail vein in both control and experimental mackerel rats, while the plasma GH-2 hormone concentration was measured using ELISA reagents.
- The weight of offspring was determined by means of an electric scale.

Results: The results, obtained by us, showed that the electromagnetic field affects both growth hormone 2 as well as offspring development and their weight, but does not affect the offspring number determined by our study. No difference in the offspring number in the control and experimental groups was obtained.

We measured the concentration of growth hormone 2 (GH2) in the blood plasma of pregnant rats and found that its concentration in the experimental group was much lower than in the control group (Figure 1).

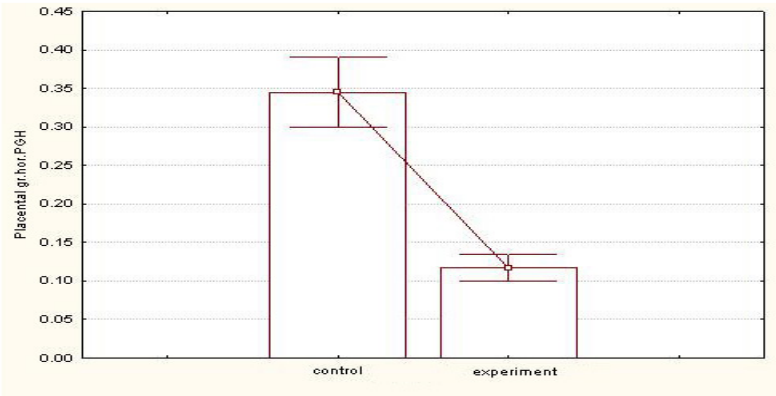

Figure 1. Concentration of growth hormone 2 (GH2) in control and experimental groups of pregnant rats.

The results of the study showed that offspring of the irradiated group of rats weighed much less at birth than those of the control group rats, which is clearly seen in Figure 2. Placental growth hormone, which affects the growth and development of the fetus, is reduced, which led to a decrease in body weight in the rats of the experimental group compared to the rats in the control group.

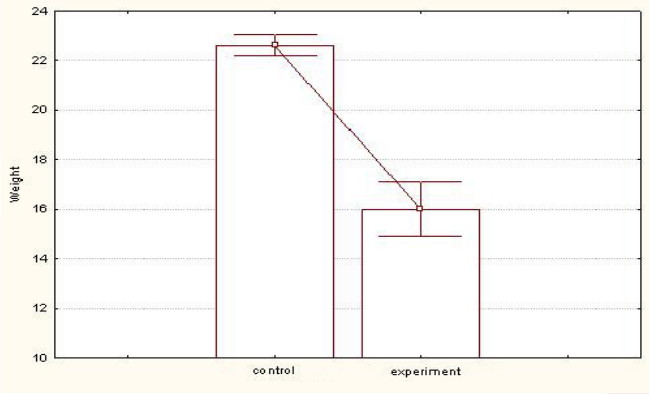

Figure 2. Offspring weight in control and experimental group

Moreover, for two weeks after birth, we were observing how the rats of the experimental and control group were developing and gained weight. Delay in limb development was observed in the experimental group, the length of the limbs and tail was shorter compared to the control group, in addition, the rats in the control group opened their eyes earlier than ones of the experimental group, and the experimental group had a delay in weight gain.

Discussion: Our experiment showed that the electromagnetic field affect on pregnant rats, their embryonic development, which is the subject of our further research. In this article, we can say, that small body weight, delayed limb development, short tail, late eyes open can be considered as indicators of the negative impact of the electromagnetic field. In our opinion, the obtained results can be explained by the fact that the electromagnetic field affects the syncytiotrophoblast layer of the placenta of pregnant rats and causes oxidative stress [5,9]. It is exactly where layer placental growth hormone is produced. It is possible that this led to a decrease in placental growth hormone concentration in the experimental group and consequently this led to weight loss in rats in the experimental group.

Conclusion: From the above we can conclude that mobile phone radiation causes significant changes in living organisms. Society, especially pregnant women, should be aware that the electromagnetic field negatively affects not only their health but also the fetus, causing certain changes. Therefore, it is necessary to limit the use of mobile phones as much as possible and use them for a certain period of time if necessary.

References:

1. Adejoke Olukayode Obajuluwa, Ayodele Jacob Akinyemi et al. ,,Exposure to radio-frequency electromagnetic waves alters acetylcholinesterase gene expression, exploratory and motor coordination-linked behaviour in male rats", Toxicology Reports. 2017; 4:530-534.
2. Ali SH Alchalabi, Erkihun Aklilu, F Abd Rahman Aziz, SH Ronald, Mohd Azam Khan. Exposure to 1800 MHz GSM-like radiofrequency electromagnetic field reduces follicular development and overall fertility of female rats. Asian Pacific Journal of Reproduction, v 3, p.1-8.
3. Bogdan Lewczuk , Grzegorz Redlarski , Arkadiusz Zak, Natalia Ziółkowska , Barbara Przybylska-Gornowicz , Marek Krawczuk. Influence of electric, magnetic, and electromagnetic fields on the circadian system: current stage of knowledge. 2014;2014:169459.
4. Djeridane Y, Touitou Y, de Seze R. Influence of electromagnetic fields emitted by GSM-900 cellular telephones on the circadian patterns of gonadal, adrenal and pituitary hormones in men. Radiation Research. 2008;169(3):337–343.
5. E. Jauniaux, A.L. Watson, J. Hempstock, Y.P. Bao, J.N. Skepper, G.J. Burton, Onset of maternal arterial blood flow and placental oxidative stress. A possible factor in human early pregnancy failure, Am. J. Pathol. 157 (2000) 2111e2122.
6. Handwerger S, The roles of placental growth hormone and placental lactogen in the regulation of human fetal growth and development, 2000 Apr;13(4):343-56.
7. Tytherleigh, M.Y. C. Webb, C.L. Cooper, C. Ricketts Occupational stress in UK Higher Education Institutions: a comparative study of all staff categories Higher Educ. Res. Dev., 2005; 24:41-61.

8. Regan L, Rai R. Epidemiology and the medical causes of miscarriage. Baillieres Best Pract Res Clin Obstet Gynaecol. 2000;14:839–854.
9. Hui-XinWu1, Yun-ZhengMu, Yue-FengHe, Ritika Rauniyar and Xi-NanWu. Testing of behavioral and cognitive development in rats after prenatal exposure to 1800 and 2400MHz radiofrequency fields, Journal of Radiation Research, 2020; 61(2):197–206.

ТЕА МУСЕЛИАНИ [1,2], МАРИНЕ НИКОЛАИШВИЛИ [1,3], ГОГИ ДЖИКИЯ [1], ХАТУНА ДОНДОЛАДЗЕ [1,2], ДАВИД НАТАДЗЕ [1]

ВЛИЯНИЕ ЭЛЕКТРОМАГНИТНОГО ПОЛЯ НА МАССУ, ЧИСЛЕННОСТЬ И РАЗВИТИЕ ПОТОМСТВА БЕРЕМЕННЫХ ОБЛУЧЕННЫХ КРЫС

[1]Центр экспериментальной биомедицины Им.И.Бериташвили, [2]Европейский университет, [3]Университет им. Гр. Робакидзе

РЕЗЮМЕ

Излучение сотового телефона вызывает значительные изменения в живом организме. Беременные женщины и дети относятся к наиболее чувствительным группам населения и особенно уязвимы к излучению электромагнитного поля. Мы решили изучить концентрацию гормона роста 2 (GH-2) у беременных крыс, подвергшихся воздействию электромагнитного поля (1800 мкг/ч), каково будет влияние электромагнитного поля как отрицательного раздражителя на массу, численность и развитие потомства. Облучение крыс во время беременности электромагнитным полем показало, что снижение гормона GH2 вызывает задержку потомства, укорочение конечностей и хвоста новорожденных крысят по сравнению с контролем, а также то, что у контрольных крыс глаза открываются раньше, чем у подопытных крыс и, следовательно, снижение массы тела крыс опытной группы. Население, особенно беременные женщины, должны знать, что электромагнитное поле негативно влияет не только на их здоровье, но и на плод, вызывая определенные изменения.

TEA MUSELIANI [1,2], MARINE NIKOLAISHVILI [1,3], GOGI JIKIA [1,2], KHATUNA DONDOLADZE [1,2], DAVIT NATADZE [1]

EFFECT OF ELECTROMAGNETIC FIELD ON THE WEIGHT, NUMBER AND DEVELOPMENT OF OFFSPRING OF IRRADIATED PREGNANT RATS

[1]Ivane Beritashvili Center of Experimental Biomedicine, [2]European University, [3]Grigol Robakidze University

SUMMARY

Radiation from a cell phone causes significant changes in a living organism. Pregnant women and children belong to the most sensitive groups of population and are particularly vulnerable to electromagnetic field radiation. We decided to study the concentration of growth hormone 2 (GH-2) in pregnant rats exposed to electromagnetic field (1800 MG/H), what the effect of electromagnetic field as a negative stimulus on offspring weight, number and development would be. Irradiation of rats during pregnancy with an electromagnetic field has shown that GH2 hormone decrease and it causes retardation of offspring, shortening of the limbs and tail of newborn rats compared to controls, and that control rats' eyes open earlier than those of experimental rats and consequently weight loss in rats in the experimental group. The public, especially pregnant women, should be aware that the electromagnetic field negatively affects not only their health, but also the fetus, causing certain changes.

Keywords: electromagnetic field, weight, development, offspring, pregnancy, irradiated rats