Does 2.4 GHz Radiofrequency Radiation (RFR) Has Potential to Treat SARS-CoV-2? – A Preliminary Observation

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Abstract

This preliminary study aimed to investigate the effect of 2.4 GHz continuous radiofrequency radiation (RFR) on SARS-CoV-2 viral load.

Samples of control and exposure groups were selected from twelve cases who were confirmed positive for SARS-CoV-2RNA by the SARS-CoV-2 Double Gene RT-qPCR kit. All groups consisted of the same patient and used 50 µl of sample. The control group was formed with 50 µl samples separated before RFR exposure and it was not exposed. The samples in the exposure groups were placed in a circle with a radius of 3 cm, 5 cm, and 10 cm. RFR antenna was placed in the middle of this circle. The samples and RFR antenna were enclosed in a Faraday cage. These samples were exposed during 1 min, 5 min, 10 min, and 20 min by RFR antenna. After exposure, determination of SARS-CoV-2RNA in exposure groups were investigated using the same kit. In this study, the effect of 2.45 GHz RF on the SARS-CoV-2 viral load was quantitatively investigated different distances and exposure times.

The statistical results of the study indicated that in all distances, 5 minutes exposure of 2.4 GHz RF altered the SARS-CoV-2 viral load ($p<0.005$).

Determining the ideal irradiation time can give a different perspective to the treatment of the disease.

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Introduction

In December 2019, a new type of corona virus, later called severe acute respiratory syndrome corona virus (SARS-CoV-2), was first detected in Wuhan, China's Hubei province, and was identified as a pandemic by the World Health Organization (WHO) when it could not be controlled. This out-of-control virus stunned the whole world, and even the world's most respected journals published studies on the subject, albeit conditionally, without serious filtering. Since the world cannot predict what kind of enemy it is fighting against, these approaches of the journal are actually acceptable, given the conditions of that day. In order to understand SARS-CoV-2, which has many points that need to be clarified, it seems that the need for studies on this virus, which is associated with other issues as well as vaccine studies, will probably not decrease in the near future. For instance, Tsiang and Havas stated that “COVID-19 cases and death rates are statistically higher in counties exposed to 5 G mmW in the United States. Mechanism may be related to alterations in oxidative stress, an impaired immune response, blood chemistry, a changed neurological and cardiovascular”.[1] Although the findings of the authors on 5G are interesting, there is a need for a wider evaluation of the studies on the subject. Therefore, we previously reviewed the molecular understanding of COVID-19 by a biophysical perspective to understand the electrostatic coaction of the virus with host cells and found that observed that there are many points that need to be clarified about the truth regarding

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COVID-19.[2]

One of the biophysical approaches is to reveal in detail whether there is a relationship between radiofrequencies and the pandemic, which has been speculated since the beginning of the pandemic. Increasing studies on the subject and therefore understanding the relationship between the pandemic and radiofrequencies may create new opportunities in all respects. Therefore, in this preliminary study, we observed effect of 2.4 GHz radiofrequency radiation on SARS-CoV-2 viral load.

Materials and methods

Ethics approval

This study was confirmed to Istanbul Medeniyet University, Göztepe Education and Research Hospital Clinical Research Ethics Committee (Decision No: 2022/0083). This study was retrospectived that analysed to SARS-CoV-2 swabs. Since it was a retrospective study, consent forms were not needed.

Swab samples and Real-Time RT-PCR

Real-time RT-PCR has become a popular molecular tool used to detect SARS-CoV-2. PCR is used to amplify the specific target gene sequence into a large number of copies using sequence-specific primers and a DNA polymerase enzyme.[3] Laboratory studies on SARS-CoV-2, the details of which have not been fully revealed yet, carry risks for researchers, but it is possible to perform them in safe laboratories. The study was carried out in a type 2 biosafety cabinet in accordance with there commendations of the World Health Organization, and FFP3 mask, facevisor, disposable apron and gloves were used during the study. Determination of SARS-CoV-2RNA in nasopharyngeal swab samples was investigated by the SARS-CoV-2 Double Gene RT-qPCR kit (Biospeedy, Bioeksen, Istanbul, Turkey) in accordance with there commendations of the manufacturer.The kit contains Viral Nucleic Acid Buffer (vNAT) enables viral nucleic acid extraction from nasopharyngeal aspirate and bronchoalveolar lavage, lavage, saliva, oropharyngeal swab, nasopharyngeal swab, and sputum samples. The vNAT component polyethyleneimine coated tetra decyldimethyl benzyl ammonium chloride-based nanoparticles (NP), BSA and tween-20. The study was included positive and negative controls and the amplification was performed using to Rotor-Gene Q (Qiagen, Hilden, Germany) device.

Electromagnetic wave application

RFR generator (220 V; 2370-2450 MHz, 0-4 Watt; Nar Technology, Kayseri, Turkey) with 2.4 GHz continuous radiofrequency radiation (RF) was used in the study. The power of the RFR generator was set to 1 Watt. Samples of control and exposure groups were selected from twelve cases who were confirmed positive for SARS-CoV-2 by the SARS-CoV-2 Double Gene RT-qPCR kit (Biospeedy, Bioeksen, Istanbul, Turkey). The control group was formed with 50 µl samples separated before RFR exposure. The control group was not exposed. All groups consisted of the same patient and used 50 µl of sample. 50 l of each sample were transferred into tubes. The samples in the exposure groups were placed in a circle with a radius of 3 cm, 5 cm, and 10 cm. RFR antenna was placed in the middle of this circle. The samples and the RFR generator were enclosed in a Faraday cage (40x30x20 cm sized cardboard box covered with aluminum foil). These samples were exposed during 1 min, 5 min, 10 min, and 20 min by RFR antenna.

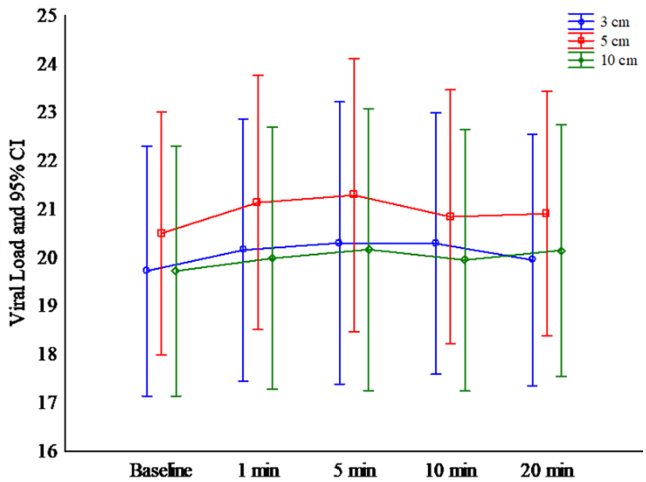
After exposure, determination of SARS-CoV-2RNA in exposure groups were investigated by the SARS-CoV-2 Double Gene RT-qPCR kit (Biospeedy, Bioeksen, Istanbul, Turkey) in accordance with the recommendations of the manufacturer. Cycle of threshold (Ct) values were recorded. Samples that did not show amplification as a result of PCR were excluded from the evaluation. The study was included in positive and negative controls and the amplification process was performed using the Rotor-Gene Q (Qiagen, Hilden, Germany) device.

	Durations										
	0 min		1 min		5 min		10 min		20 min		p
Distance	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	
3 cm (n=10)	19,825	3,238	20,200	3,532	20,423	3,772	20,401	3,715	20,152	3,479	0,0003
5 cm (n=11)	20,847	4,575	21,427	4,434	21,677	4,945	21,217	4,561	21,253	4,385	0,0001
10 cm (n=10)	19,825	3,238	20,109	3,664	20,284	3,868	20,074	3,429	20,165	3,449	0,0001

Table 1. Mean viral loads and standart deviations for different durations (0 min, 1 min, 5 min, 10 min, 20 min) and distances (3 cm, 5 cm, 10 cm). p values were obtained using repeated measurements analysis.

Evaluating of samples

The point which the sigmoidal curve obtained from the samples intersects the threshold line show the cycle value of threshold (Ct). The Ct is high in those with low viral load. In those with a high viral load, Ct is low. At the end of the study, statistical analysis was performed according to Ct values. In comparison of Ct values, repeated measures ANOVA analysis and Bonferroni test were used and $p<0.05$ was considered significant (Table 1, Graphic 1).



Graphic 1. Relation between viral load (95 % CI) and exposure durations for three distances.

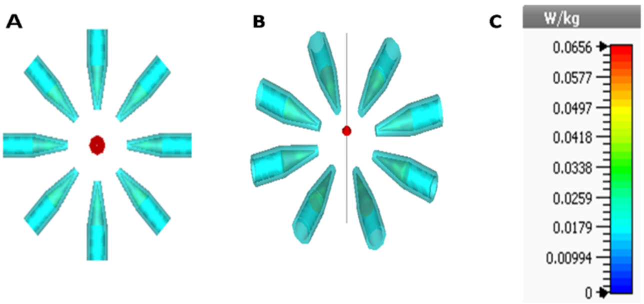


Figure 1. SAR simulation setup and results scale for 10 cm radius exposure. (a) Top view side. (b) View (red dot represents excitation point). (c) SAR averaging for 0.357g.

Specific absorption rate (SAR) simulations

Experimental setup was modeled in 3D electromagnetic and thermal solver using Microwave Studio (CST Studio Suite). CST utilizes finite integration technique to solve Maxwell's equations in volumetric pixels. Finite integration is a hybrid technique of finite difference and integral equation solvers. WiFi transmit power of 100 mW (20 dBm) was used in the simulations. Standard SAR simulations are run for either 1g or 10g averaging. However, total mass of the samples is 0.357g, which is much smaller than standard averaging masses. Therefore, 0.357g averaging is used in SAR simulations. Point and average SAR values for 3 cm radius are 176.8 mW/kg and 1891 mW/kg, respectively; for 5 cm radius of exposure 118.2 mW/kg and 905 mW/kg, respectively; for 10cm radius of exposure 65.6 mW/kg and 694 mW/kg, respectively (Figure 1).

Statistical analysis

In this study, SARS-CoV-2 viral load values for three distance and exposure times were summarized as means and standard deviations. The comparisons were done using repeated measurements ANOVA method and post-hoc Bonferroni test. All statistical analysis were done by means of STATISTICA 13.0 software. Statistical significant value was $p<0.05$.

Results

Ct values of 12 samples were given in the Table 1. When the mean Ct values of 12 samples that were found to be positive for SARS-CoV-2 RNA were compared with out applying RFR and after applying RFR at the specified time and distances, there was no significant difference between the application distances ($p<0.739$). In all distances, the change between exposure times were obtained as statistically significant and viral load at 5 min exposure increased significantly from baseline. When the application times were compared, it was found that 5 min exposure caused a statistically significant increase in Ct values (respectively; $p<0.0003$, $p<0.0001$ and $p<0.0001$). Relation between viral load (95 % CI) and exposure durations for three distances given in the Graphic 1.

Discussion

In this study, the results we obtained regarding the effects of 5 min exposure of 2.4 GHz continuous wave RFs on SARS-CoV-2 viral load can be considered valuable. However, it is very difficult to predict what kind of mechanisms are behind the determined short and effective time. However, it is more plausible to admit that electrostatic interactions play a role in the interaction between radiofrequency radiation (RF) and SARS-CoV-2. For instance, Siber et al.

specified that "the energy of protein–genome packaging significantly affects from electrostatic nature. The data displayed that electrostatic coactions between components of a virus, such as the genome molecule and proteins significantly limit the dimension and structure of viruses".[4] On the other hand, Song et al. suggested that the electrostatic potential interface of Zika Virus (ZIKV) could alter the binding properties of protective antibodies.[5] However, Li reported an extensive set of electrostatic features of currently available SARS-CoV-2- related structures inside Protein Data Bank (PDB).[6] On the other hand, Kettleson et al. investigated virus capture and inactivation in air at voltages of -10 to +10 kV using an electrostatic precipitate and showed significant potential in virus capture and inactivation by continuous ion.[7] Considering the electrostatic interactions of viruses, it is conceivable that the RFs used in this study may have the potential to generate electrostatic changes during the interaction of 2.4 GHz RF radiations with the SARS-CoV-2 virion. At this point, there is little research to show that electromagnetic fields can kill viruses or the coronavirus specifically. Irradiation of the SARS-CoV-2 spike protein by a non-thermal 700W, 2.45 GHz electromagnetic field for 2 minutes was denatured the protein approximately 95%.[8] However, many highly comprehensive studies are needed to prove this or to understand what is behind of it. Additionally, considering the relationships established between long-term RF exposures and other diseases, especially cancer, the possibility of a 5-minute 2.4 GHz RF exposure to have a positive effect is the pleasing aspect of this study that our study indicated that in all distances, 5 minutes exposure of 2.4 GHz RF altered the SARS-CoV-2 viral load. The results obtained in this study have the potential to bring new aspects in reducing SARS-CoV-2 viral load in ambient air and in host as well. In a nationwide study in Denmark, Lyngse et al. reported that, individuals with lower Ct values in SARS-CoV-2 RT-PCR test, which indicates higher viral load, are related to higher risk of SARS-CoV-2 transmission.[9] Furthermore, in a systematic review by Rao et al. it is stated that lower cycle threshold (Ct) values may be associated with more severe clinical outcomes and that Ct values may be used as a prognostic marker for COVID-19.[10] Similarly, higher SARS-CoV-2 viral load has also been found to be associated with mortality in patients hospitalized due to COVID-19.[11,12]

Therefore, it is of great importance to reduce the viral load in the treatment of COVID-19 which is also aimed by the antiviral drugs. Also, further studies on investigation of how to eliminate SARS-CoV-2 from indoor air can be considered extremely important, especially when taking the extent of the pandemic into account and how much the air indoors can be contaminated with the viral particles due to infected individuals. On the other hand, as a toxic environmental cofactor 5G of wireless communications radiation (WCR) may have contributed to the COVID-19 pandemic.[13] Increased exposure to electromagnetic fields or EMFs generated by 5G devices may not cause COVID-19, but the studies shows that it increases an susceptibility of the individual to COVID-19 by reducing immunity and increasing respiratory complications.[14] Tsiang and Havas stated that, 5G technology is associated with higher COVID-19 case and death rates because of the relation between RF exposure and changes in blood chemistry, oxidative stress, an impaired immune response, an altered cardiovascular and/or neurological response. It is not known how right they are about their concerns, but there are many studies suggesting that there is a relationship between long-term RF exposures and various diseases, especially brain tumors. Therefore, their results cannot be compared with our results, as we observed the positive effect of the 5 min 2.4 GHz RF radiation exposure.

Conclusions

The results we obtained in this study may be stimulating for future studies, but many detailed studies are required. In conclusion, although Tsiang and Havas stated that "Exposure to 5G mmW technology is statistically significantly associated with higher COVID-19 case and death rates in the U.S.A. the relationship between radiofrequency radiations and SARS-CoV-2 is not yet clear". However, in our study we found that 5 min 2.4 GHz RFR exposure caused a statistically significant increase in Ct values ($p<0.019$). Although this result is promising, it is not sufficient. Therefore, much more scientific work is needed to establish the accuracy of the ideas discussed here.

Declaration of Interest

The authors report no conflict of interest.

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