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EFFECT OF HYDROALCOHOLIC EXTRACT OF NASTURTIUM OFFICINALIS ON OXIDATIVE AND ANTIOXIDANT INDICES CAUSED BY ELECTROMAGNETIC RADIATION EMITTED FROM WI-FI ROUTERS

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ABSTRACT

Background: Wi-Fi radiation increases the oxidative damage index and decreases antioxidant defense. The Nasturtium officinalis has antioxidant and cleansing properties of free radicals. The aim of this study was to investigate the effect of hydroalcoholic extract of Nasturtium officinalis on oxidative and antioxidant indices caused by electromagnetic radiation emitted from Wi-Fi routers in rats.

Materials and Methods: 20 Wistar rats were divided into four equal groups: control, Wi-Fi radiation, Nasturtium officinalis extract and Wi-Fi+Nasturtium officinalis extract. The extract groups received 125 mg/kg of the hydroalcoholic extract of the Nasturtium officinalis, and the radiation groups were exposed to radiation from the Wi-Fi router one hour a day. Before and 48 hours after intervention, Plasma evels of superoxide dismutase(SOD), glutathione peroxidase(GPx), total antioxidant capacity(TAC) and malondialdehyde (MDA) were measured and data were analyzed using one-way ANOVA, T-dependent and Tukey sequencing tests ($P<0.05$).

Results: One-way ANOVA showed significant differences among different groups. Tukey's test results showed that the difference between the radiation+extract group

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With the extract group in all variables and With the control group in the variables SOD, GPx and TACwas not significant. Also, the difference between the control group and the extract group in the TAC variable was not significant.

Conclusion: It seems that receiving 125 mg/kg of hydroalcoholic extract of Nasturtium officinalis can decrease oxidative stress indices caused by Wi-Fi radiation and increase of antioxidant enzymes.

Key Words: Oxidative Stress, Wi-Fi, Nasturtium officinalis, Electromagnetic Radiation

INTRODUCTION

The use of radio frequency(RF) and electromagnetic radiation(EMR) devices has increased significantly in everyday life and has raised serious concerns about the effects of radiation from these devices on human health (1). Electromagnetic radiation, including waves emitted from Wi-Fi routers, has been raised as a new oxidizer, which can increase free radicals, including reactive oxygen species (2,3). In normal conditions, free radicals and antioxidants are in a balanced state. Increasing the production of free radicals from antioxidant defense can lead to oxidative stress(4-6) and the consequences of such an increase in ROS, simulate NADH oxidase and damage DNA, proteins and lipids, and a wide range of oxidative damage, and in the long run cause health risks (7,8).

The results of the study by Chauhan et al Indicated a significant increase in malondialdehyde (MDA) as a lipid peroxidation index and a significant reduction in superoxide dismutase(SOD) in rats exposed to microwave radiation (2.45 GHz) (9). Pourfazeli et al showed that eight weeks of radiation emitted from the Wi-Fi modem increased MDA and reduced SOD, glutathione peroxidase (GPx) and total antioxidant capacity (TAC) (10,11). Several researchers found that exposure to the EMR of 2.45 GHz increased the level of MDA and reduced glutathione peroxidase (GPx) levels (3,12,13). Atasoy et al Showed that exposure to the 2.4 GHz Wi-Fi ray reduces the level of activity of antioxidant enzymes (3). On the other hand, some studies have also shown that exposure to EMR does not reduce GPX and SOD in laboratory animals (14,15).

The use of medicinal herbs has long been common among people in Iran. Nasturtium officinalis(watercress) is a herbaceous plant that runs automatically along the fountains and clear waters in different regions of Iran (16,17). Studies show that this plant contains beta-carotene, ascorbic acid, calcium, folic acid, iron, iodine, phosphorus, amino acids such as arginine, glycine, lysine and tryptophan (18). Oral consumption of this plant is effective in reducing plasma glucose in diabetic rats and has a strong anti-Scurvy effect, so that it can

reduce the complications of vitamin C deficiency in the short term (19). In addition, there is evidence that the raw extract of this plant protects rat ovaries against radiation, and this therapeutic effect is attributed to the antioxidant capacity (20,21).

The presence of a high level of antioxidant substances such as flavonoids in the grass plant shows that this plant has the accumulation of free oxygen radicals and is capable of protecting cells from chemical damage, drugs and stress (22) . In addition, phenyl isocyanate, which is found in abundance in Nasturtium officinalis , has biological anti-inflammatory activity (23). Shen and et al reported that the fountain grass increases the intracellular free-calcium concentration and decreases oxidative metabolites of acetaminophen, which is likely to do this by inhibiting oxidative metabolism (24).The results of Zargari et al. Study showed that grass sprinkler extract (200 and 500 mg / kg body weight) increased the activity of antioxidant enzymes GPx, SOD and TAC in rats that were poisoned with arsenic (25,26) . The results of the study by Bahrami Kia et al. Indicated that grass sprinkler extract inhibits lipid peroxidation by preventing the reactivity of thiobarbituric acid (18).

Because a significant portion of the population exposed to radiation from Wi-Fi modems overnight could increase oxidative stress, and on the other hand, Nasturtium officinalis can reduce the levels of oxidative stress caused by Other sources. Therefore, the purpose of this study was to investigate the effect of hydroalcoholic extract of Nasturtium officinalis on oxidative stress indices caused by radiation emitted by Wi-Fi modems.

MATERIALS AND METHODS

In this experimental study, 20 Wistar male Wistar rats weighing 200 grams and an average age of 9 weeks were taken to the animal lab. The code of research ethics was obtained from R.YUMS.REC.1395.172 from Yasouj University of Medical Sciences and interventions were carried out based on the protocol for the use of animals approved by the university. Animals had free access to water and food and kept at a temperature of 22-26° C and a 12-hour dark / light period. Animals were randomly divided into four groups of five groups: the first control group, the second group exposed to the Wi-Fi radiation (daily for one hour), the third group receiving the extract of Nasturtium officinalis (daily 125 mg per kg body weight) and the group Fourth, exposed to the Wi-Fi+Nasturtium officinalis extract.

Radiation and radiation groups + Grass sprinkler sprinkled with a Wi-Fi modem (27) for 1 hour per week during 8 weeks at a frequency of 45.2 GHz. In order to minimize the interference and effect of other beams on the results of the study, there were no other radioactive devices during the study in the laboratory up to 25 meters. The third and fourth

groups received 125 mg per kg of body weight hydroalcoholic extract of the Nasturtium officinalis for 8 weeks. Rats were taken from the heart immediately before and 48 hours after the last session of the intervention and after about 10-12 hours of fasting, using intraperitoneal injection of ketamine and xylosin anesthetized and blood samples directly from their heart (28,29).Blood samples were stored for 10 minutes with 1000 rpm centrifuges and plasma separated at -70° C until the test (28). Plasma levels of SOD, GPX and TAC capacity were measured by ELISA method using laboratory assay kit kit manufactured by ZellBio GmbH, Germany (Cat.No: ZB-TAC-A96) and Malone dealdead (TBA) with homogenous sample (29,30). In order to implement the project in one-stop, biochemical measurements of variables and analysis of data were carried out by colleagues who did not know how to group the samples. In order to minimize the error of the test, measurements for one variable were performed on a day.

Preparation method for grass sprinkler extract

The Nasturtium officinalis was turned into powder in the vicinity of the air and in a dry shade, and then by an electric mill. For one hundred grams of powder, eight hundred ml of ethanol was added to seventy percent. The solution was filtered at 24° C for 20-25° C using a shaker and filtered with Watten No. 1 filter paper. The Hydroalcoholic ethanol solvent was added to the residue and mixed for 24 hours using a shaker. Preparation of hydroalcoholic extract of grass sprinkler was carried out using a rotary distillation apparatus in vacuum. The extract was stored at -20° C in the freezer until the test was performed.

DATA ANALYSIS

For statistical analysis and comparison between groups, ANOVA test was used and Tukey's post hoc test was used to determine the difference between the groups. Also t-test was used to evaluate intra-group changes. The significance level was $P \leq 0.05$ and data analysis was performed using SPSS software version 23.

FINDINGS

In Table 1, the results of one way ANOVA show that there is a significant difference between SOD, GPX, TAC and MDA levels between different research groups. Daily use (125 mg/kg) of Nasturtium officinalis caused significant increase in SOD, GPX, TAC (P=0.001), and significant decrease in MDA plasma level (P=0.001) has been exposed to waves exposed to rats.The results of t-test showed that there is a significant difference between the pre-test and post-test levels of kidney variables in the radiation, extract and radiation + extract groups. In

other words, the interventions significantly alter the post-test variables compared to the pre-test stage.

In Table 2, the Tukey test results showed that the difference between the control group and the radiation group and the difference between the radiation group and the extract group and the radiation+extract in all variables and the difference between the radiation group and extract group were significant in SOD, GPx and MDA variables . But the difference between the control group and the radiation+extract group in SOD, GPx and TAC variables was not significant with the extract group in the TAC variable and the difference between the extract group and the extract+extract group in all variables ($P<0.05$).

Table 1. One-way ANOVA and dependent t-test for examining changes in variables in the studied groups

Variable	Groups	Control	Radiation	Nasturtium officinalis	radiation +Nasturtium officinalis	F	P1
SOD (U/ml)	Pre test	33.2 ± 5.6	32.7 ± 4.5	31.6 ± 5.3	33.4 ± 5	0.11	0.449
	Post test	32.4 ± 5.1	21.6 ± 2.4	37 ± 3.3	35.2 ± 4.3	15.20	0.001*
	P2	0.60*	0.002*	0.009*	0.012*		
GPX (U/ml)	Pre test	100 ± 3.7	100 ± 5.5	99.6 ± 5.9	100 ± 5.3	0.66	0.977
	Post test	101.4± 3.8	86.8 ± 3.4	107.8 ± 3.7	106.8 ± 6.6	22.35	0.001*
	P2	0.553	0.001*	0.013*	0.005*		
TAC (Mm)	Pre test	1.04± 0.10	1.02± 0.03	0.99 ± 0.06	1 ± 0.05	0.481	0.70
	Post test	1.04± 0.10	0.69± 0.20	1.05± 0.05	1.07± 0.04	10.68	0.001*
	P2	0.742	0.016*	0.006*	0.002*		
MDA (µmol)	Pre test	3.22± 0.48	3.16± 0.44	3.25± 0.54	3.19± 0.45	0.030	0.993

	Post test	3.19± 0.46	3.69± 0.34	2.81± 0.62	2.60± 0.46		
	P2	0.268	0.001*	0.002*	0.001*		

P1: meaningful inter-group P2: meaningful intra-group P≤0.05

Table 2. Tukey test results to determine the place of difference between the groups in the studied variables (based on the difference in mean)

Group1	Group2	SOD	GPx	TAC	MDA
control	Radiation	0.001*	0.001*	0.001*	0.001*
	Nasturtium officinalis	0.002*	0.007*	0.819	0.001*
	radiation +Nasturtium officinalis	0.724	0.067	0.281	0.001*
radiation	Nasturtium officinalis	0.001*	0.001*	0.001*	0.001*
	radiation +Nasturtium officinalis	0.001*	0.001*	0.001*	0.001*
Nasturtium officinalis	radiation +Nasturtium officinalis	0.086	0.692	0.998	0.101

P≤0.05

DISCUSSION AND CONCLUSION

In this study, the effect of hydroalcoholic extract of Nasturtium officinalis on antioxidant enzymes and lipid peroxidation caused by radiation emitted by Wi-Fi modem were evaluated. One-way analysis of variance analysis showed significant differences between different groups of research. The results of the dependent t test also indicated that these changes were caused by the intervention (Table 1). Eight weeks of exposure to Wi-Fi at 45.2 GHz caused a decrease in plasma levels of SOD, GPx and TAC, and an increase in MDA. The results of this study were consistent with the results of Chauhan et al. (2017), Pourfazli et al. (2017), Oksia et al. (2014), Attasy et al. (2013), Nazir et al (2012), and Yinalali et al. (2013) (3, 9, 10, 12, 13, 30). However, it was not consistent with the results of studies by Tarker et al. (2014) and Gani et al. (2013). On the other hand, administration of 125 mg / kg hydroalcoholic extract of Nasturtium officinalis for 8 weeks increased the plasma levels of SOD, GPx and TAC and decreased MDA in intervention groups.Regarding this part of the change, the results of this

research are consistent with the results of Zargari et al. (2015), Bahramiya Kia et al. (2010), and Zargari et al. (2015) (18, 25,26).

cells are equipped with an antioxidant defense system to counteract oxidative stress and Generally, phytochemicals such as beta-carotene have the effects of free radicals cleansing (31-35). and therefore Nasturtium officinalis can prevent oxidative stress (36). The levels of enzymatic antioxidants have a major impact on the readiness of various tissues in comparison with oxidative damage. Despite numerous anti-oxidant defense systems, these products sometimes exceed the cell defense capacity and damage such as lipid peroxidation, protein deficiency And activation of enzymes (37).However, antioxidant supplementation seems to be able to some extent prevent cellular damage caused by this type of stress. The results of this study showed that administration of 125 mg/kg of hydroalcoholic extract of grasses, although it increased the level of SOD, GPx and TAC.

Therefore, reducing the amount of MDA and increasing the plasma level of antioxidant enzymes in extract and extract + extract groups can be due to the presence of antioxidant substances in the grass plant. Due to the high level of antioxidants such as flavonoids in the grass, this plant has an accumulation capability of free oxygen radicals (25). The cumulative results clearly show that the Nasturtium officinalis extract has strong antioxidant properties, which is likely to do this through direct shaking of free radicals, reducing power, and also through the Metal rolls. Based on the potential of antioxidant, extractNasturtium officinalis extract may be useful in preventing radical-free disease (18).

According to the results of this study, administration of 125 mg/kg of hydroalcoholic extract of grasses per day could decrease MDA as an index of lipid peroxidation and oxidative damage and, on the other hand, increase the plasma levels of antioxidant enzymes And antioxidant capacity is reduced and reduces the oxidative stress associated with exposure to Wi- Fi radiation.It is suggested that, in order to clarify the various aspects of the research, other studies have been done to compare the effect of other medicinal herbs on oxidative stress markers of electromagnetic radiation.

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