

Abstract

The last few decades have seen a boom in the communications sector with an exponential growth in the number of wireless devices based on non-ionizing radiation. Among various wireless devices, mobile phones are the most widely used and have become an integral part of modern life. Research suggests that exposure to radiofrequency electromagnetic radiation is associated with a higher risk of hypertension and dyslipidemia. Literature data show that the increase in energy load affects the variability of risk factors contributing to the adverse effect of electromagnetic radiation on the cardiovascular system.

Cardiovascular diseases are the leading cause of mortality worldwide. The World Health Organization has stated that accurate and timely diagnosis of cardiovascular disease is essential for the treatment of this condition. In addition, developing countries need inexpensive alternatives to effectively prevent cardiovascular disease. Natural plant-based antioxidants such as beetroot and pomegranate juices, as well as vitamin K, may be the answer. Dietary vitamin K is thought to reduce the risk of cardiovascular disease by reducing coronary calcification seen in atherosclerosis.

The main objective of this dissertation was to determine the effect of electromagnetic radiation on the development of atherosclerotic lesions in ApoE/LDLR^{-/-} mice fed a diet rich in antioxidants. Hypotheses on the influence of the electromagnetic field on the development of atherosclerosis and on the anti-atherosclerotic effect of antioxidants were verified on the basis of a pilot study and three feeding experiments on an animal model of atherosclerosis (ApoE/LDLR^{-/-} mice), as well as one experiment conducted using the C57BL/6J mouse model. In the experiment evaluating the effect of the electromagnetic field in ApoE/LDLR^{-/-} mice, a significant increase in the area of atherosclerotic lesions was observed, and therefore nutritional factors, i.e. antioxidants, that would inhibit the progression of atherosclerosis were sought. In the experiment with the addition of vitamin K1, a reduction in total cholesterol and LDL cholesterol was observed in the C57BL/6J mice receiving a diet supplemented with vitamin K1. These favorable results prompted an analogous experiment using the ApoE/LDLR^{-/-} mouse model of atherosclerosis, however, supplementation with vitamin K1 did not show a significant and beneficial anti-atherosclerotic effect in animals. Therefore, in the next experiment, beetroot juice and pomegranate juice, which are characterized by antioxidant activity, were used. A significant effect of beetroot juice consumption on weight reduction was demonstrated. An unfavorable change in the lipid profile was found under the influence of juices. A significantly lower share of total saturated fatty acids and higher desaturation indices

were observed in the fatty acid profile. Histological analyzes showed a slightly smaller area of atherosclerotic lesions in the entire aorta using beetroot juice in the diet and in the initial section of the ascending aorta when pomegranate juice was used. Suggesting promising histological results from the experiment with the addition of juices in the diet, an experiment was performed in which the effect of two factors was combined, i.e. the electromagnetic field and beetroot juice and pomegranate juice. The applied electromagnetic field, and the addition of beetroot juice and pomegranate juice had the effect on the fatty acid profile by lowering the share of saturated fatty acids and also reduced the desaturation index. In this experiment, a significant effect of antioxidants on the reduction of atherosclerotic surface in ApoE/LDLR^{-/-} mice during exposure to electromagnetic radiation was found.

In conclusion, electromagnetic radiation adversely affects atherosclerotic lesions, causing their growth, which confirms the hypothesis. In the case of the use of vitamin K1, no anti-atherosclerotic effect was observed and the hypothesis assuming the anti-atherosclerotic effect of this vitamin was not confirmed, in contrast to beetroot juice and pomegranate juice, where no progression of atherosclerotic changes was found. As a result, antioxidants administered in the form of juices with the simultaneous exposure to electromagnetic radiation showed anti-atherosclerotic activity. The obtained result proves the confirmation of the assumed hypothesis regarding the influence of beetroot and pomegranate juices on the reduction of atherosclerotic lesions with simultaneous exposure to the electromagnetic field.

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