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Histomorphometric and immunohistochemical study of lycopene effect on dopamine receptors and GABA neurons after induction of Parkinson's disease in adult male rats

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Parkinson's disease, which affects approximately 200 out of every 100,000 people, is the second most common progressive neurodegenerative disorder after Alzheimer's disease. The primary cause of the disease is progressive destruction of dopaminergic neurons in midbrain and impairment in GABA receptors. Today, there are various methods of treatment for patients with Parkinson. Most of them are medication therapies which have multiple complications. So, the present study aimed to investigate the effect of lycopene as an antioxidant and neuroprotective substance, on dopamine receptors and GABA neurons after induction of Parkinson's disease. A total number of 105 adult male Wistar rats were randomly divided into 7 groups, in this study: Control group (healthy rats without receiving any material); patient group (one-way injection of 6-hydroxy dopamine (0.5 µL) into substantia nigra by Hamilton Needles to induce Parkinson's disease); Sham group (one-way injection of ascorbic acid (0.02%) into substantia nigra); lycopene control group (gavage, lycopene (0.5 ml/kg)); treated group with lycopene (induction of Parkinson's disease+gavage, lycopene (0.5 ml/kg)); treated group with anti-Parkinson medicine, Levodopa, (induction of Parkinson's disease+intraperitoneally injection of Levodopa (10 ml/kg)); treated group with Levodopa and lycopene (induction of Parkinson's disease+gavage administration of lycopene (0.5 ml/kg)+intraperitoneally injection of Levodopa (10 ml/kg)). 15, 30 and 60 days were considered as the sampling days. During these days, a number of 5 rats in each group were anesthetized and killed by human method and without pain. Then their brains were removed for tissue processing. After tissue processing and preparation of microscopic slides, the density of D1, D2 receptors and GABA neurons was histomorphometrically examined by immunohistochemistry method. Reduced number of D1, D2 receptors and GABA neurons in cerebral cortex and cerebellum was lower in patient groups compared with control group, in each of the three studied times, and there was no significant difference. While, the reduction was greater in thalamus, substantia nigra, amygdale and hippocampus, and there was a significant difference between control and patient groups (≤p 0.05). Increased number of D1, D2 receptors and GABA neurons in the treated groups in all organs and sampling days was more effective in the treated group with lycopene and levodopa compared with both separately treated groups with lycopene and levodopa. Increased number of D1, D2 receptors and GABA neurons in the treated groups only had significant difference in two organs, substantia nigra and amygdale, compared with the patient group (≤p 0.05). According to the obtained results, it can be stated that due to neuroprotective and anti-oxidant properties of lycopene extract, it reduces complications and somewhat improves Parkinson's disease.

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