ANTIOXIDANT AND NEUROPROTECTIVE EFFECTS OF 'AS-SABR' AND 'AS-SEDAN' IN AN $ALCl_3$-INDUCED NEUROTOXIC MODEL

Obidova Shoxsanam Akromjon kizi
Postgraduate Researcher, Andijan State University
Lecturer, Department of Biological Chemistry, Andijan State Institute of Medicine

ANNOTATION: This study investigated the antioxidant and neuroprotective properties of the dietary supplements "As-Sabr" and "As-Sedan" based on biomarkers obtained from an aluminum chloride ($AlCl_3$)-induced neurotoxic model, including malondialdehyde (MDA), diene conjugates (DC), the activity of catalase and superoxide dismutase (SOD) enzymes, and total protein levels. The preparations, developed from *Valeriana officinalis L.*, *Matricaria chamomilla L.*, *Melissa officinalis L.*, *Urtica dioica L.*, *Hypericum perforatum L.*, and *Jasminum officinale L.*, were tested in an in vivo model. The results demonstrated that "As-Sabr" and "As-Sedan" exert neuroprotective and adaptogenic effects on the nervous system by reducing $AlCl_3$-induced oxidative stress, inhibiting lipid peroxidation, restoring antioxidant enzyme activity, and stabilizing protein-metabolic balance.
Keywords. $AlCl_3$; neurotoxic model; "As-Sabr"; "As-Sedan"; antioxidant activity; neuroprotective effect; catalase; superoxide dismutase; malondialdehyde; diene conjugates; biochemical biomarkers.

INTRODUCTION

In recent years, neurodegenerative processes and toxic encephalopathies associated with environmental factors, heavy metals, and their salts (including aluminum chloride – $AlCl_3$) have increased sharply. $AlCl_3$ enhances oxidative stress in central nervous system cells, stimulates lipid peroxidation, reduces the activity of antioxidant defense enzymes (catalase, superoxide dismutase), and leads to protein-metabolic imbalance [1]. This mechanism resembles the pathogenesis of Alzheimer's disease, Parkinson's disease, and neurocirculatory dystonia, and therefore the $AlCl_3$ model is considered an important experimental platform for evaluating neuroprotective agents [2]. Natural plant extracts are distinguished by their ability to reduce oxidative stress, maintain membrane stability, and exhibit neuroprotective properties. The richness of *Valeriana officinalis L.*, *Matricaria chamomilla L.*, *Melissa officinalis L.*, *Urtica dioica L.*, *Hypericum perforatum L.*, and *Jasminum officinale L.* in phenolic compounds, flavonoids, vitamins, and mineral elements makes them promising sources for the treatment of nervous system disorders [3,4]. Therefore, this study aimed to evaluate the antioxidant and neuroprotective properties of the dietary supplements "As-Sabr" and "As-Sedan" in an $AlCl_3$-induced neurotoxic model based on biochemical biomarkers (MDA, DC, catalase, SOD, total protein). The study focused on scientifically substantiating the protective mechanisms of these preparations against oxidative stress, their effects on lipid peroxidation, and their role in enhancing the reparative capacity of nervous tissues.

MATERIALS AND METHODS

Objects of the study. For the experimental work, 30 healthy male rats weighing 150–200 g were used. The animals were kept in the animal facility of the Biochemistry Department of the Tashkent Pharmaceutical Institute (or the name of your laboratory). Housing conditions: temperature 22–24 °C, humidity 40–60%, natural light cycle; their diet consisted of wheat, pistachio, milk and dairy products, wheat bread, beans, meat and egg products, and free access to clean drinking water. Prior to the experiment, the animals underwent a 2-week adaptation period.

Neurotoxic model. To model neurotoxic injury to the central nervous system, the rats received intraperitoneal injections of a 10% aluminum chloride ($AlCl_3$) solution at a therapeutic dose for 3 days. This method induces oxidative stress, lipid peroxidation, and neurometabolic imbalance in animals and is accepted as a neurotoxic model resembling Alzheimer's disease.
Preparations. The experimental groups received the plant-based dietary supplement “As-Sabr” and the herbal tea “As-Sedan” orally, administered with the laboratory diet. The preparations were formulated using *Valeriana officinalis L.*, *Matricaria chamomilla L.*, *Melissa officinalis L.*, *Urtica dioica L.*, *Hypericum perforatum L.*, and *Jasminum officinale L.*

Biochemical indicators. To evaluate the antioxidant and neuroprotective effects of the preparations, the following biomarkers were determined from the rats’ blood serum and brain tissues: Malondialdehyde (MDA) level- determined by the TBARS (2-thiobarbituric acid) method, measuring optical density at 532 nm; Diene conjugates (DC) level- assessed by heptane–isopropanol extraction and UV spectrum at 232 nm; Catalase activity- measured spectrophotometrically at 410 nm based on termination of H_2O_2 decomposition with ammonium molybdate; Superoxide dismutase (SOD) activity- determined by the Misra–Fridovich method, based on reduced nitroblue tetrazolium (NBT) inhibition; Protein content- determined by the Biuret method, colorimetrically at 540–560 nm. All analyses were performed using modern laboratory equipment: K-7000 or Shimadzu UV-Vis spectrophotometer (China/Japan), centrifuge (BIOBASE Mini-7, China), analytical balance (OHAUS NV222, USA). Each indicator was measured in triplicate and expressed as mean ± standard deviation.

Statistical analysis. Data were analyzed using Student’s t-test or one-way ANOVA, and $p < 0,05$ was considered statistically significant.

Results. The $AlCl_3$-induced neurotoxic model sharply increased oxidative stress and lipid peroxidation markers in the central nervous system of rats. Compared to the control group, MDA and diene conjugate levels in the model group increased by 1.5–2 times, while catalase and SOD activities significantly decreased ($p < 0.01$). Protein levels also showed changes consistent with metabolic imbalance. In the groups treated with the dietary supplements “As-Sabr” and “As-Sedan,” biochemical indicators showed a tendency toward normalization. Specifically, MDA levels decreased by up to 30%, indicating a sharp reduction in terminal lipid peroxidation products ($p < 0.05$). The levels of diene conjugates approached those of the control group, demonstrating restoration of membrane lipid stability. Catalase and SOD activities increased by 20–40% compared to the model group, indicating reactivation of the antioxidant defense system. Protein levels approached those of the healthy group, reflecting restoration of tissue trophism and metabolic processes. When “As-Sabr” and “As-Sedan” were administered together, these effects became even more pronounced: MDA and DC levels dropped to minimal levels, and catalase and SOD activities reached maximal values ($p < 0.01$). This indicates that these preparations possess synergistic antioxidant and neuroprotective properties.
The experimental results confirm that “As-Sabr” and “As-Sedan” reduce oxidative stress, stabilize lipid membranes, and enhance the antioxidant defense system in the $AlCl_3$-induced neurotoxic model. This provides scientific evidence of their protective and adaptogenic potential for the nervous system.

CONCLUSION

The results of the study showed that the $AlCl_3$-induced neurotoxic model leads to oxidative stress, lipid peroxidation, and disruption of the antioxidant defense system in rats. This condition was manifested

by decreased catalase and superoxide dismutase activities, increased levels of MDA and diene conjugates, and an imbalance in protein metabolism. In the groups treated with “As-Sabr” and “As-Sedan,” these pathological changes were significantly alleviated: lipid peroxidation markers decreased, catalase and SOD activities increased, and protein levels normalized. Combined administration of these preparations produced a synergistic effect, enhancing their neuroprotective and antioxidant properties. Thus, the dietary supplements “As-Sabr” and “As-Sedan” protect the nervous system in the $AlCl_3$-induced neurotoxic model by reducing oxidative stress, maintaining membrane stability, and restoring the antioxidant defense system. These dietary supplements can be scientifically recommended as promising biologically active agents for the prevention and complex treatment of nervous system disorders.

References

1. Hritcu L., Cioanca O. Prevalence of use of herbal medicines and complementary and alternative medicine in Europe //Herbal Medicine in Depression: Traditional Medicine to Innovative Drug Delivery. – Cham: Springer International Publishing, 2016. – С. 135-181.
2. Motti R., de Falco B. Traditional herbal remedies used for managing anxiety and insomnia in Italy: An ethnopharmacological overview //Horticulturae. – 2021. – Т. 7. – №. 12. – С. 523.
3. TANRIKULU N. Comparative research of findings of some medicinal plants in traditional medicine, folk medicine, and scientific studies. – 2024.
4. Agelet A., Bonet M. À., Vallés J. Homegardens and their role as a main source of medicinal plants in mountain regions of Catalonia (Iberian Peninsula) //Economic Botany. – 2000. – Т. 54. – №. 3. – С. 295-309.
5. Stoyanov S., Apostolova-Stoyanova N. Checklist of the flora in the Rusenski Lom River Valley (Northeast Bulgaria) //Phytologia Balcanica. – 2024. – Т. 30. – №. 1.