

NEUROPROTECTIVE EFFECTS OF METFORMIN AGAINST METHYLPHENIDATE-INDUCED NEUROTOXICITY

Implications for Neurodegenerative Diseases

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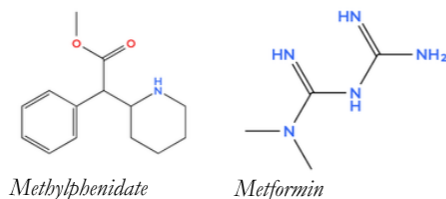


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Background

Methylphenidate is widely used for ADHD but may induce oxidative stress, neuroinflammation and neuronal damage. These mechanisms are implicated in neurodegenerative diseases such as Alzheimer's disease. There is therefore a paucity of safe, accessible neuroprotective interventions.



Problem Statement

Chronic exposure to methylphenidate may contribute to neurotoxicity, yet no widely accessible protective therapy exists.

Aim

To evaluate the neuroprotective potential of metformin against methylphenidate-induced neurotoxicity, focusing on:

- neuroinflammation
- cholinergic dysfunction
- behavioral outcomes

Methodology



This was an experimental animal study using albino mice administered oral methylphenidate (MPH) and varying doses of metformin (MET).



The sample size consisted of 60 female mice randomly split into six groups. Except for the control and MET-only groups, MPH dosage of 10mg/kg was maintained. Treatments were administered once a day for 21 days.



Data was collected through a battery of assessments, including behavioural tests, open field tests, an elevated plus maze (to assess anxiety levels), tail suspension tests as well as biochemical analyses for IL-6, TNF- α and AChE activity.



Data analysis was via one-way ANOVA followed by Tukey's post-hoc multiple comparison test. Statistical difference was set at $p < 0.05$ across all data.

Results

Metformin significantly:

- Reduced neuroinflammation ($\downarrow$ IL-6, TNF- α)
- Improved cholinergic function (normalized AChE activity)
- Improved behavioral outcomes

The effects were dose-dependent, with a 100mg/kg co-administration of MET yielding preferential outcomes.

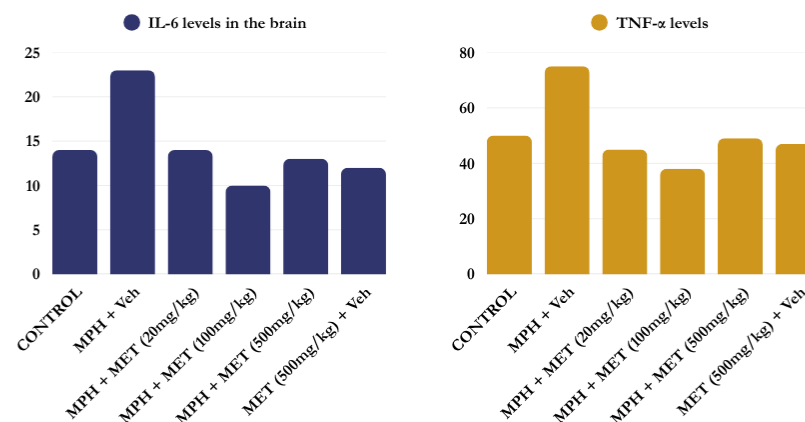
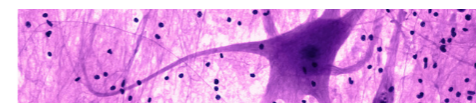
Key Findings

1. Metformin attenuates methylphenidate-induced neurotoxicity.
2. Demonstrates neuroprotective and anti-inflammatory properties
3. Supports drug repurposing strategy

Significance

This study summarily addresses two major global burdens: ADHD and Alzheimer's disease, which have a cumulative impact on over 400 million¹ adults globally.

The impact of these findings is that metformin has considerable potential for safer long-term ADHD management, early intervention strategies for neurodegeneration and cost-effective therapeutic options for low-resource settings.



1. Song P., Zha M., Yang Q., Zhang Y., Li X., Rudan I; GHERG.

The prevalence of adult attention-deficit hyperactivity disorder: A global systematic review and meta-analysis. J Glob Health 2021; 11:04009