METFORMIN AND ITS USAGE IN ALZHEIMER'S DISEASE

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ABSTRACT

Alzheimer's Disease (AD) is a progressive neurodegenerative disorder with limited treatment options. Metformin, an oral anti-diabetic drug, has shown potential neuroprotective effects. This study investigates Metformin's role in treating AD by reviewing literature, clinical trial data, and FDA drug approval archives. Findings indicate that Metformin enhances insulin sensitivity, reduces neuroinflammation, and improves cognitive function in AD patients. These results suggest that Metformin could be a promising therapeutic agent for AD, warranting further clinical trials to confirm its efficacy and explore its full potential.

OVERVIEW

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- Purpose of Research
- Problem Statement
- Research Question
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INTRODUCTION

Overview of Alzheimer's Disease (AD)

- AD is a neurodegenerative disorder characterized by progressive cognitive decline, memory loss, and behavioral changes.
- It is one of the leading causes of disability and dependency among older adults worldwide, with a growing prevalence due to aging populations.

Introduction to Metformin

- Metformin is an oral anti-diabetic medication primarily used to treat type 2 diabetes by improving insulin sensitivity and lowering blood glucose levels.
- Beyond its primary use, Metformin has been associated with various health benefits, including potential anti-cancer and anti-aging properties and neuroprotective effects.

PURPOSE OF RESEARCH

Primary Aim

- To investigate the potential role of Metformin in the treatment of Alzheimer's Disease, exploring its efficacy and mechanisms of action.

Secondary Objectives

- To investigate the concept of Type 3 diabetes and its affiliation with Alzheimer's disease.
- To evaluate FDA-authorized oral anti-diabetic pills and their mechanisms of action (MOA), with a detailed focus on the MOA of metformin.
- To examine the history and improvement of metformin as a therapeutic agent.
- To explore the reasons and symptoms of Alzheimer's disorder.
- To assess the role of metformin in treating Alzheimer's disease, including its potential mechanism and clinical efficacy
- To review different diseases treated with metformin beyond diabetes.

PROBLEM STATEMENT

Alzheimer's Disease Challenge

- AD poses a significant public health challenge, with increasing incidence rates and substantial economic and social burdens on patients, families, and healthcare systems.
- Current treatment options for AD are limited and primarily focus on managing symptoms rather than addressing the underlying disease mechanisms or halting progression.

Potential of Metformin

- Emerging evidence suggests that Metformin may offer neuroprotective benefits, potentially impacting disease mechanisms such as insulin resistance, neuroinflammation, and amyloid-beta accumulation.
- This research aims to explore these potential benefits in depth, providing insights into Metformin's therapeutic potential for AD.

RESEARCH QUESTIONS

Key Questions

- How does Metformin affect biochemical pathways associated with Alzheimer's Disease, particularly regarding insulin signaling, inflammation, and amyloid-beta production?

- What are the comparative benefits of Metformin versus other anti-diabetic drugs in AD management, and how do their mechanisms of action differ in the context of neuroprotection and cognitive function improvement?

LITERATURE REVIEW

1 Summary of Existing Research

- Overview of studies on Metformin's primary use in diabetes management, highlighting its role in improving insulin sensitivity and glucose metabolism.
- Exploration of Metformin's off-label uses in other conditions, including cancer, aging, and neurodegenerative diseases, emphasizing its potential as a multi-faceted therapeutic agent.

2 Clinical Trial Data

- Review of clinical trials examining Metformin's effects on cognitive function, neuroinflammation, and amyloid plaque formation in AD patients, providing evidence of its potential neuroprotective benefits.

3 Mechanisms of Action

- Discussion of how Metformin activates AMP-activated protein kinase (AMPK), influences insulin signaling pathways, and modulates neuroinflammatory responses, potentially leading to reduced amyloid-beta accumulation and neuroprotection.

METHODOLOGY

Research Design

Mixed-methods approach integrating quantitative and qualitative data to provide a comprehensive understanding of Metformin's potential in AD treatment.

Data Sources

Review of existing literature, clinical trial results, and FDA drug approval records, ensuring a thorough and evidence-based analysis of Metformin's effects on AD.

Analysis Techniques

- Descriptive statistics for quantitative data, providing numerical insights into Metformin's efficacy and safety profile.
- Systematic literature review for qualitative insights, synthesizing findings from various studies to identify common themes and gaps in the existing research.

RESULT

- Enhanced insulin sensitivity in AD patients treated with Metformin, potentially mitigating insulin resistance, a common feature in AD pathology.
- Reduced neuroinflammation and amyloid plaque levels, suggesting that Metformin may influence key pathological processes in AD.
- Cognitive improvements were observed in clinical trials, with Metformin-treated patients showing better performance on cognitive assessments compared to control groups.
- Activation of AMPK pathways, leading to potential neuroprotective effects through improved cellular energy metabolism and reduced oxidative stress.

CONCLUSION

Metformin presents a promising avenue for AD treatment due to its neuroprotective properties, with evidence suggesting benefits in terms of cognitive function, insulin sensitivity, and neuroinflammation.

Implications for Future Research

- **Emphasis on the need for further clinical trials to confirm findings, expand understanding of Metformin's applications in AD, and explore its full therapeutic potential.**

- **Importance of investigating the long-term effects of Metformin treatment in AD patients, as well as potential interactions with other AD treatments and comorbid conditions.**

RECOMMENDATIONS

Recommendation 1

Explore the mechanisms of action underlying Metformin's neuroprotective effects, particularly its impact on insulin signaling, neuroinflammation, and amyloid-beta metabolism.

Recommendation 2

Consider Metformin as a potential adjunct therapy for patients with both diabetes and early-stage AD, while monitoring for potential side effects and interactions with other treatments.

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THANK YOU

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