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polyphenolic compounds exhibit selective antimicrobial properties and may contribute to the establishment of a favorable microbial balance in the gastrointestinal tract.

The obtained results are also consistent with the findings of Fijan [4], who reported that probiotic microorganisms demonstrate enhanced viability and metabolic activity in the presence of specific plant-derived bioactive compounds. Therefore, medicinal plant extracts may function as natural prebiotic-like agents capable of improving probiotic performance and promoting intestinal health.

Conclusion. The present study demonstrated that bioactive compounds isolated from medicinal plants exert a positive influence on the growth and metabolic activity of probiotic microorganisms. Extracts rich in phenolic compounds and flavonoids significantly enhanced the proliferation of probiotic strains belonging to the genera *Lactobacillus* and *Bifidobacterium*. Similar conclusions regarding the beneficial interaction between phytochemicals and probiotic microorganisms have been reported in previous studies [1, 2, 5]. These findings provide valuable scientific evidence supporting the utilization of medicinal plant-derived bioactive compounds in the development of novel synbiotic preparations and functional food products. Further investigations involving metabolomic and genomic approaches are recommended to elucidate the molecular mechanisms underlying these interactions [5].

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SYNTHESIS AND PHARMACOLOGICAL POTENTIAL OF PYRIMIDINE DERIVATIVES IN NEURODEGENERATIVE DISEASES

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Abstract. Pyrimidine derivatives represent a vital class of heterocyclic compounds with broad pharmacological applications, particularly in the treatment of neurodegenerative disorders such as Alzheimer's disease (AD) and Parkinson's disease (PD) [1]. These disorders are characterized by progressive neuronal degeneration, oxidative stress, and neurotransmitter imbalance [2]. This review systematically analyzes recent advances (2010–2025) in the synthesis and biological evaluation of pyrimidine-based compounds. Various synthetic methodologies, including cyclization, multicomponent reactions, and nucleophilic substitution, have been employed to generate structurally diverse derivatives [3]. Pharmacological studies demonstrate that these compounds exhibit significant acetylcholinesterase inhibition, antioxidant, anti-inflammatory, and neuroprotective activities [5], [6]. Structure–activity relationship (SAR) analysis indicates that substitution patterns on the pyrimidine ring critically influence biological activity [4]. Overall, pyrimidine scaffolds offer promising potential for the development of multi-target-directed ligands for neurodegenerative diseases [7].

Introduction. Neurodegenerative diseases such as Alzheimer's disease (AD) and Parkinson's disease (PD) are among the most challenging health conditions worldwide, characterized by progressive neuronal loss and cognitive decline [1]. The multifactorial nature of these diseases, including oxidative stress, neuroinflammation, and protein aggregation, necessitates the development of multi-target therapeutic agents [2].

Heterocyclic compounds play a crucial role in medicinal chemistry, and pyrimidine is a key structural motif present in nucleic acids and several clinically active drugs [3]. Due to its versatile chemical properties, the pyrimidine scaffold has been extensively explored for designing biologically active molecules [4].

Recent research highlights that pyrimidine derivatives exhibit diverse pharmacological activities such as enzyme inhibition, neuroprotection, and anti-inflammatory effects, making them promising candidates for the treatment of central nervous system (CNS) disorders [4], [5].

Research methodology. This study is a systematic narrative review conducted to evaluate the synthesis and pharmacological potential of pyrimidine derivatives in neurodegenerative diseases.

A comprehensive literature search was performed using databases including PubMed, ScienceDirect, SpringerLink, and Google Scholar. The search period covered January 2010 to March 2025. Relevant keywords such as “pyrimidine derivatives AND neurodegenerative diseases” and “pyrimidine AND Alzheimer's disease” were used.

Inclusion criteria involved peer-reviewed studies focusing on synthesis and biological evaluation, while non-peer-reviewed and irrelevant studies were excluded. Data extracted included synthetic strategies, pharmacological activities, and SAR insights.

Results and Discussion

Synthetic Approaches. Several synthetic strategies have been employed for the preparation of pyrimidine derivatives, including cyclization reactions involving β -dicarbonyl compounds, multicomponent reactions (MCRs), and nucleophilic aromatic substitution (SNAr) reactions [3]. These methods provide flexibility in designing structurally diverse compounds with improved pharmacological profiles.

Structure–Activity Relationship (SAR). SAR studies reveal that electron-donating groups enhance antioxidant activity, while halogen substitutions improve lipophilicity and CNS penetration [4]. Furthermore, fused pyrimidine systems have been associated with enhanced enzyme inhibition and improved pharmacological efficacy [3]. These findings indicate that minor structural modifications significantly influence biological activity.

Conclusion. Pyrimidine derivatives constitute a promising class of compounds for the development of novel therapeutics targeting neurodegenerative diseases. Advances in synthetic methodologies and pharmacological evaluation have demonstrated their potential as multi-target agents [6], [7].

Future research should focus on clinical validation, optimization of pharmacokinetic properties, and the development of selective and potent derivatives to enhance therapeutic efficacy.

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SYNTHESIS AND RESEARCH OF DIALDEHYDINULIN

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In recent years, the natural polysaccharide inulin has attracted increasing attention from researchers. Inulin is an organic compound from the polysaccharide group, consisting of β -D-fructose residues linearly linked by 2,1- β bonds. At the end of the