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HOW A HEALTHY LIFESTYLE CAN PREVENT OR SLOW THE ONSET OF PARKINSON'S DISEASE

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ABSTRACT

Parkinson's disease (PD) is the second most common neurodegenerative disease, right after Alzheimer's disease (AD). This paper aims to give a holistic overview of the factors (including diet, exercise, sleep, and mental wellness) that can directly impact brain health and the chances of developing PD. Regular exercise has varied effects on neurological health, including increased neuroplasticity, reduced neuroinflammation, and increased dopamine levels. 30 minutes of exercise per day is optimal to promote heart, brain, and overall body health. The diet also plays an important role in promoting brain health. This paper draws attention to the Mediterranean diet, which comprises several foods composed of naturally occurring anti-inflammatory agents and antioxidants, e.g., polyphenols. Omega-3 fatty acids are instrumental in maintaining brain structure. Sleep is vital for maintaining neurological health. The glymphatic system removes the potentially neurotoxic waste built up in cells. This reduces the risk of neuroinflammation. Better sleep also promotes better mental well-being, and blue light exposure before sleeping should be avoided for restful sleep. Disruptions to the circadian rhythm could mean a higher risk for Parkinson's disease. Prioritizing mental well-being is important to reduce the risk of chronic stress and neuroinflammation. Early life stress can greatly augment a person's chances of getting Parkinson's disease. Stress management, of any form (e.g., meditation, praying, having companion animals), can help alleviate stress.

KEYWORDS: Parkinson's Disease (PD), Anti-Inflammatory Agents, Antioxidants, Stress Management, Neurological Health, Neuroinflammation, Serobic Exercise

INTRODUCTION

Parkinson's Disease (PD) is a neurodegenerative disease. Symptoms of the disease include bradykinesia, tremors, slurred and broken speech, and postural instability. It affects 0.1-0.2% of people, increasing to over 1% in people above 60. Around 5-10% of people with the disease have a genetic predisposition for it (Zafar & Yaddanapudi, 2024). The disease greatly reduces the quality of life.

This paper will discuss factors including sleep, mental well-being, diet, and exercise and how they impact a person's chances of getting PD. A healthy lifestyle comprising regular exercise, a balanced diet, sufficient sleep, and stable mental health should reduce a person's risk for Parkinson's disease or slow down the progression of the disease.

Oxidative stress, neuroinflammation, and α-synuclein buildup are linked to mitochondrial dysfunction and dopamine loss, contributing to PD symptoms. Mitochondrial dysfunction can result in improper ATP (adenosine triphosphate) production and, as a result, death of neuronal cells (Clemente-Suárez et al., 2023). Another risk factor is neuroinflammation, which over prolonged periods can cause disruptive changes in mood, behavior, and functioning of the body (Neuroinflammation, Pain, and Fatigue Lab at UAB, 2016). Another risk factor lies in the buildup of mutated α-synucleins as Lewy bodies in neurons in the substantia nigra, hindering the production of dopamine (*Parkinson's Disease*, n.d.). The lessened levels of dopamine can also cause disruptions in the basal ganglia circuitry, accounting for the observable symptoms of PD. This loss can be caused by a genetic predisposition attributable to several genes, including SNCA, DJ-1, and PINK1. Environmental stressors, including pesticides, can also be linked to PD (*Parkinson's Disease*, n.d.). There is currently no known treatment for the disease, but medications and procedures (e.g., deep brain stimulation (DBS)) can lessen the effects of symptoms.

However, the effects and prevalence of neurodegeneration can be ameliorated by neuroprotection. Neuroprotection is an effect that may result in salvage, recovery, or regeneration of the nervous system, its cells, structure, and function (Vajda, 2002). It can be achieved by lifestyle changes that promote neurogenesis and slow neurodegeneration.

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LITERATURE REVIEW

Exercise is known to support neuroplasticity, promote dopamine production, and reduce inflammation, all of which may help mitigate the progression of neurodegenerative diseases such as Parkinson's disease (PD). By improving cardiac efficiency, exercise enhances blood flow to the brain, which aids in synaptic plasticity, modulates angiogenesis, and activates glial cells critical for brain health (Lin et al., 2018). Dopamine production stimulates the production of cytokines and BDNF (brain-derived neurotrophic factor), which have anti-inflammatory effects. BDNF especially contributes to neurogenesis.

A healthy diet is fundamental for brain health, with the Mediterranean diet particularly noted for its neuroprotective effects. This diet, which includes abundant fruits, vegetables, whole grains, nuts, olive oil, and moderate fish and poultry, is rich in polyphenols, antioxidants, and anti-inflammatory compounds. Polyphenols, naturally occurring in fruits, vegetables, and olive oil, have been linked to increased lifespan and reduced risk of age-related diseases (Luo et al., 2021). Their anti-inflammatory and antioxidant properties help counter chronic inflammation and oxidative stress, both implicated in neurodegeneration.

Polyphenols' antioxidant properties help reduce oxidative stress through mechanisms such as the neutralization of reactive oxygen species (ROS), activation of anti-inflammatory genes (via Nrf2), and regulation of oxidative stress-related microRNAs (Luo et al., 2021). Omega-3 fatty acids, particularly DHA, DPA, and EPA, are also beneficial for brain health. DHA supports brain structure and neural communication, while DPA and EPA reduce inflammation (Dyall, 2015). Together, polyphenols and omega-3 fatty acids increase brain-protective factors like BDNF, which helps form new neurons and strengthens brain connections.

Sleep is crucial to brain health by supporting memory, metabolism, and mental clarity. During sleep, the glymphatic system clears excess proteins from the brain that accumulate throughout the day, including potential neurotoxic proteins (Eugene & Masiak, 2015). This clearance process reduces the risk of neuroinflammation. Sleep disturbances, which are common in PD, can exacerbate neurodegeneration by disrupting circadian rhythms and the glymphatic system, leading to cognitive and neurological decline (Gros & Videnovic, 2019).

Parkinson's disease can also mark the beginning of multiple sleep disorders, including RLS, EDS, and insomnia, all of which negatively affect circadian rhythm and exacerbate neurodegeneration. With Parkinson's disease, these disorders can quicken neurological deterioration (Gros & Videnovic, 2019). A longitudinal study of 2,930 men suggests that disruptions in circadian rhythms may serve as early indicators of PD. Those with decreased circadian amplitude, mesor, or robustness were at a significantly higher risk of developing PD. This finding highlights the potential role of circadian disruption as an initial feature of PD and underscores the need for further studies across diverse populations to establish these associations definitively.

Mental well-being plays an instrumental role in maintaining brain health as well. Stress over extended periods can turn into chronic stress. Chronic stress can cause inflammation and the secretion of cortisol. Early-life stressors can also cause late-onset neurodegenerative effects.

In summary, current research indicates that lifestyle factors such as exercise, diet, and sleep quality may delay or reduce the risk of PD. However, more longitudinal studies and rigorous randomized control trials (RCTs) are needed to elucidate these relationships and explore their causal links. Future studies should incorporate diverse, representative samples to increase generalizability. A deeper investigation into the underlying biological mechanisms may help identify targeted lifestyle interventions to prevent or delay PD onset.

METHODOLOGY

This study followed a secondary qualitative methodology; all sources for this review were obtained from scientific databases, including Google Scholar and ScienceDirect, as well as from peer-reviewed medical journals and research publications. All sources were published between 10 and 20 years ago to evidence the evaluations and cover all aspects effectively.

RESULTS & DISCUSSION

Physical Activity

A lot of research into the effects of physical exercise on neurological health and Parkinson's disease has been conducted. To unearth the effects of multi-component exercise in older people compared to traditional PD exercises, researchers conducted a 12-week-long study on two groups of individuals with Parkinson's Disease—Mild Cognitive Impairment (PD-MCI)—an intervention group and a control group. The intervention group completed 12 weeks of a multi-faceted exercise regimen, while the control group did the traditional exercises recommended by healthcare providers. The intervention group saw a significant improvement in cognitive, motor, and psychological functions after 12 weeks, with high retention (95.7%) rates and adherence (99.6%) rates (Xu. et al., 2024).

In one study, 19 healthy middle-aged adults were made to complete 35-minute sessions of physical exercise, cognitive training, and mindfulness practice. Upon measuring the changes in BDNF levels after each intervention, significant results were observed—physical activity significantly augmented BDNF levels, while mindfulness exercises and cognitive training showed no significant results. This links exercise with increased BDNF levels (Håkansson et al., n.d.).

In another experiment, mice were induced with PD using MPTP treatment. MPTP treatment is a neurotoxin that mimics PD by targeting cells based in the substantia nigra. Mice were divided into groups for sedentary behavior, early training (before and during MPTP treatment), and late training (after treatment). Results showed both early and late training preserved dopaminergic neurons and enhanced levels of neurotrophic factors BDNF and GDNF, indicating that physical exercise can provide neuroprotective effects regardless of onset timing.

This supports the potential for physical activity as a beneficial intervention at any stage of PD (Palasz et al., 2019).

Aerobic exercise has been shown to have the greatest effect on cognitive functioning. It is proven to diminish the risks of dementia and major cognitive impairment. Trials investigating aerobic exercise and its effects have shown increased cognitive functioning, hippocampal volume, and preserved grey matter (Ahlskog et al., 2011).

Diet and Nutrition

Dietary choices can play an important role in brain health. Researchers conducted a cross-sectional study consisting of 76 people (36 men and 41 women) of ages older than 75 on average. The study was conducted in a Mediterranean city (Garrucha, Spain). The MeDi Adherence Screener (MEDAS) test was used to measure adherence to the Mediterranean diet. MMSE and GDS evaluations correlated with the MEDAS scores, and a significant correlation between the MMSE and MEDAS scores was observed; there was no correlation between GDS and MEDAS scores, however (Hernández-Galiot & Goñi, 2017). Later, a study conducted amongst 2092 Greek elderly people aimed to find the correlation between adherence to the Mediterranean diet, cognitive decline, and depressive symptoms. Initial assessments showed that 34.4% of the sample was cognitively impaired and 32.3% of the sample experienced depressive symptoms. 52.1% of the sample either loosely adhered to the diet or did not follow it. Evaluations of the Mini-Mental State Examination (MMSE) and Geriatric Depression Scale (GDS) scores showed that greater adherence to the diet was associated with higher MMSE and GDS scores, showing that the Mediterranean diet did indeed improve cognitive functioning and reduce depressive symptoms (Mantzorou et al., 2020).

Lower saturated fat intake has also been associated with a lower risk of developing PD. A longitudinal study assessing the long-term effects of diet, exercise, and obesity on cognitive function later in life was conducted on 522 middle-aged people with improper glucose tolerance. They underwent a four-year-long intervention by the researchers and then yearly check-ins for the next nine years into senility. They included clinical evaluations and records of food and physical exercise questionnaires. The result showed that a lower intake of total and saturated fats was associated with higher cognitive performance. High BMIs and waist circumference were associated with lower cognitive functioning (Lehtisalo et al., 2015).

The gut-brain axis connects the gastrointestinal tract and the central nervous system (CNS). Probiotics, in a study, have been proven to improve glucose metabolism and lower inflammation and oxidative stress (Leta et al., 2021). Cocoa flavanols have also been proven to improve cognitive dysfunction in elderly people, which could be useful in younger people as well through future studies (Mastroiacovo et al., 2023).

Sleep and Rest

The AARP Sleep and Brain Health Survey of 2016 revealed a list of important details about the link between sleep and brain health. The survey was conducted online amongst 2464 people above the age of 40 (353 Hispanics/Latinos, 352 African Americans, and 205 Asian Americans). They found that (a) adults who sleep better rate their brain health better, (b) adults who rate the quality of their sleep to be higher get more sleep on average and have higher mental well-being scores, (c) one in four sleep worse than they did five years ago, and (d) the most common activities adults engage themselves in an hour before bedtime are watching television or browsing the web (Mehegan et al., 2017).

The first point is important in proving the correlation between sleep and brain health. Sleep, as established before, is vital in clearing out the cell waste in the brain. Better sleep would mean less waste lingers in the neural cells. The second is important in showing that sleep duration affects a person's sleep quality and overall mental well-being. Proper sleep duration (i.e., 7-9 hours) allows the body to run five to six uninterrupted sleep cycles, during which memory consolidation and neurogenesis occur (Eugene & Masiak, 2018). 26% of the participants have also mentioned that they slept better five years ago, which can be accounted for by the decreased melatonin production in aging adults.

The most common pre-sleep habit is watching television or browsing the Internet. A review conducted by several researchers aimed at exploring the connection between digital media use (of all forms, including smartphones, television, laptops, gaming, etc.) and sleep onset latency and duration found that in Western countries, amongst 16-25-year-olds, increased usage of digital media before bed was associated with later sleep onset and decreased sleep duration. One of the hypotheses connected exposure to blue light and disruptions to the circadian rhythm by inhibiting melatonin secretion (Brautsch et al., 2021). Hence, not consuming digital media at least an hour before bed allows younger adolescents to fall asleep faster.

Mental Health, Mental Wellness, and Cognitive Training

A survey (and interview) conducted by the AARP (2018) shed light on some major relationships between brain health and mental well-being in individuals aged 18 and older. They found that young adults had lower well-being scores than the silent generation (73-90). Chronic stressors (which are much more stressful than acute stressors) had a greater prevalence among young adults compared to the silent generation. Chronic stressors can include the loss of a loved one, moving, childhood trauma, etc. They also found that stress decreased with age and that stress management increased mental well-being scores (Mehegan & Rainville, 2018). It is safe to infer that stress management can directly reduce the chances of PD.

Another paper analyzing the mechanisms behind the correlation between early childhood trauma and late-onset cognitive decline says that this particular chronic stressor can impact hippocampal function over time and slowly develop into memory impairment in the later stages of life (Brunson et al., 2005).

Studies into cognitive training and activity have also been conducted. A study into the effects of cognitively stimulating leisure activity (CSLA) on cognitive functioning proved the aforementioned correlation (Litwin et al., 2016). Pets have also helped in improving the mental health of some older individuals (Cherniack & Cherniack, 2014). However, it is important to note that pets can be the cause of stress for first-time owners ("puppy blues"). It is also worth mentioning that this is not a scientifically recognized condition that can be diagnosed.

CONCLUSION

All of these factors intertwine to form the basis of a healthy lifestyle. To maintain neurological health, one should exercise at least 30 minutes per day (per professionals' recommendation) and eat a balanced diet, including aspects of the Mediterranean diet. Adolescents and adults should get at least 8-10 hours and 7-9 hours of sleep, respectively. Stress management should also be implemented through meditation or social engagement. Pets could also reduce the effect of mental stress. Research is yet to be conducted into the factors underlying PD progression. More longitudinal studies with larger and more diverse samples need to be explored. Indeed, PD is more prevalent among specific ethnic groups, but why? More research should be conducted to explore these research questions.

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