Link Between Dopamine and Parkinson's Disease

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***Parkinson's disease is the second most prevalent neurodegenerative disease. It usually starts with a small tremor in the hand and progresses over time to interfere with muscle movement, gait, balance, sleep and eventually cognitive functioning. Parkinson's disease is believed to result from the loss of cells in the brain that produce dopamine, which sends messages between nerve cells to coordinate muscle movement and other critical functions.***

## Key takeaways:

- There is no known cure for Parkinson's disease.
- Medications treat the symptoms of Parkinson's disease, especially in the early stages, but have unpleasant side effects, such as dizziness, nausea, vomiting, tiredness, dry mouth and hallucinations.
- A balanced diet, high in tyrosine, a building block of dopamine, helps the body naturally replenish dopamine in the early stages of Parkinson's disease.

→ Decreasing stress and anxiety, adequate sleep and physical activity are helpful in conserving the dopamine that brain cells produce.

# What is dopamine?

Dopamine is known as the **"feel good hormone."** It is produced by cells in the substantia nigra portion of the hypothalamus, at the base of your brain. Dopamine has two purposes:

- **Movement**. As a neurotransmitter, dopamine is a chemical that helps electrical information move through your brain to produce smooth and controlled muscle movements.
- **Mood**. Functioning as a neurohormone as well, dopamine is secreted when you engage in something good or that brings you pleasure. It motivates you to do the activity again and raises your mood.

Dopamine is also produced by the gastrointestinal system. It is one of the hormones and neurotransmitters that assist communication between the brain and the gut. Changes in your gut can result in changes in your brain that may affect your cognitive functions, behavior and circadian rhythm. Dopamine produced in the gut affects your gastrointestinal motility.

As dopamine levels fall, constipation becomes one of the more troubling symptoms of

Parkinson's disease. With less dopamine, the protective mucosa of the lining of the intestine is affected, allowing undigested food, bacteria and toxins to be absorbed into the bloodstream, resulting in an inflammatory process. These neurotoxic changes can affect your ability to swallow, smell, produce saliva and speak.

## How is dopamine produced?

Your body makes the dopamine it needs from the food you eat and your activity. Nerve cells in the base of your brain, the substantia nigra, take tyrosine, an amino acid found in the protein you eat, and convert it to levodopa or L-dopa, another amino acid. Enzymes then turn levodopa into dopamine.

# Dopamine and Parkinson's disease link

Parkinson's disease is a neurocognitive disorder. The classic symptoms are hand tremors, muscle stiffness and rigidity, shuffling gait, depression, decreased gastrointestinal motility, urinary and sexual dysfunction, depression, hallucinations and dementia.

It is believed that Parkinson's disease is caused by loss of cells in the brain that produce dopamine. It is thought that approximately 60% to 80% of the cells in the substantia nigra must be lost before you will exhibit symptoms of Parkinson's disease.

In addition to cell loss, two critical pathways in your brain that transport dopamine, the

mesolimbic pathway and the nigrostriatal pathway, stop communicating with other nerve cells. Decreased levels of dopamine and pathways that cannot connect, eventually result in visible symptoms with changes in muscle flexibility, gait, coordination, and mood to name a few.

Researchers have not determined why the cells that produce dopamine are lost or the pathways lose their connection. They cite a combination of genetic and environmental factors. There is also no known cure for Parkinson's disease.

## What are signs of low dopamine?

Lack of motivation or ability to focus, moodiness, anxiety, depression, poor coordination, stooped posture, tiredness, small hand tremors or loss of smell are early signs of diminished dopamine.

**Later signs of significantly decreased dopamine levels, include:**

- Severe tremors and shaking
- Rigidity or stiffening of the muscles
- Shuffling gait
- Falls
- Stooped posture
- Difficulty chewing and swallowing
- Hallucinations
- Sleep problems
- Constipation

- Depression
- Sexual dysfunction
- Dementia

## Can you test your dopamine levels?

There is no single test that confirms that you have Parkinson's disease. However, there is a **dopamine transporter scan** (Da Tscan) used by healthcare professionals that helps rule out other potential causes of your symptoms. In the Da Tscan, radioactive material is administered intravenously to provide a contrast, so the amount of dopamine in the brain can be seen. The test is not used if you have obvious symptoms of Parkinson's disease.

## Can dopamine be replenished naturally?

A well-balanced **diet and active lifestyle** may help your brain increase its production of dopamine, despite the loss of brain cells that produce it. Dietary recommendations have included eating a diet high in magnesium and tyrosine, the amino acid that is a building block of dopamine. Eating foods that already contain dopamine will not help the dopamine levels in the brain. It is more effective to eat food with tyrosine, the precursor to dopamine.

Sources of tyrosine include:

- Lean animal protein, such as chicken, turkey, seafood

- Eggs
- Bananas
- Avocados
- Dairy (not low-fat)
- Nuts, such as almonds
- Soybeans
- Sesame seeds
- Pumpkin seeds
- Oatmeal
- Beans
- Whole grains
- Apples, oranges
- Green, leafy vegetables.

Increasing dopamine building blocks, like tyrosine, will not stop the development of Parkinson's disease, however, it may **slow the onset of symptoms.** The Mediterranean diet may also decrease early symptoms of Parkinson's disease, especially gastrointestinal and non-motor symptoms, due to its healthy balance of healthy proteins, fats and anti-inflammatory effects.

Foods that you should not eat, as they may worsen symptoms, include foods high in saturated fats, sweets and sugary drinks, large amounts of alcohol and processed foods (canned foods, soda, bacon, ready meals, candy, chips). These foods may release large amounts of dopamine, giving you a temporary "feel good" sensation, but such foods are detrimental to your overall health.

## Other ways to support dopamine levels

There are other healthy habits you can develop to support your dopamine levels. Stress causes the release of a large amount of dopamine. **Decreasing stress** by listening to music, meditation or spending time outside will conserve dopamine levels. Other healthy habits like getting sufficient sleep, drinking lots of filtered water to stay hydrated and getting enough exercise will help support your general health and body functions.

# Medical ways to treat dopamine deficiency:

The dopamine deficiency in Parkinson's disease cannot be treated by simply giving a pill or injection of dopamine. Dopamine in this form will not cross the blood-brain barrier to get to where it needs to be to do its work.

## Levodopa and carbidopa

There are several other medications that are used to treat Parkinson's symptoms. Levodopa is an amino acid, a building block, that is turned into dopamine by the body. It cannot replace all the dopamine lost due to the loss of substantia nigra cells, but it does help to decrease Parkinson's symptoms.

Certain blood enzymes (AADCs) cause most of the levodopa to break down before it reaches the brain. To prevent this breakdown, carbidopa

is added to the levodopa (Sinemet) to inhibit the effects of these enzymes.

Carbidopa stops the breakdown of levodopa in the gastrointestinal tract and liver, thus allowing more of it to get to the brain, where it is turned into dopamine.

## Dopamine agonists

These medications imitate dopamine by binding to dopamine receptors in your brain and activate them just like dopamine would. These medications include bromocriptine, pramipexole, ropinirole and pergolide. These medications can be prescribed with levodopa as well. They can be used to treat early symptoms or throughout the disease process to enhance the effects of levodopa in later stages.

## Selegiline

Selegiline decreases the metabolism of dopamine in the brain by slowing the enzyme activity of monoamine oxidase B (MAO-B), which breaks down dopamine. It will work with both naturally occurring dopamine and dopamine that is formed from doses of levodopa.

## Anticholinergic medications

Benztropine mesylate, biperiden HCL, trihexyphenidyl and procyclidine block acetylcholine in the brain. The result is a decrease in tremors and muscle rigidity.

## Amantadine

Amantadine is an antiviral medication that reduces early symptoms of Parkinson's Disease. It can be used with anticholinergic medication or levodopa. It is often used to treat jerky muscle movements.

# Side effects of dopamine-boosting medication

The major problem with using medications to replenish dopamine or treat the symptoms of Parkinson's Disease is the side effects, including, dry mouth, dizziness, faintness, nausea, vomiting, and tiredness. Some people, especially the elderly, may experience more serious side effects, such as urinary retention, constipation, confusion, psychosis or hallucinations.

Despite our knowledge of the link between dopamine and Parkinson's disease, no cure has been found. Medications can make a significant difference in early to moderate stages of Parkinson's disease when shakiness, tremors, muscle rigidity, shuffling gait, lack of focus and moodiness become pronounced.

However, these medications have side effects. The best defense against early symptoms of Parkinson's disease may be a diet rich in tyrosine and other healthy nutrients, to support the natural production of dopamine. Increasing physical activity and engaging in practices that reduce stress, such as music, meditation, and a

healthy amount of sleep, may also help conserve the dopamine that you produce.

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## Resources:


1. Nutrition and Lifestyle Interventions for Managing Parkinson's Disease: A Narrative Review.
2. Randomized Delayed-Start Trial of Levodopa in Parkinson's Disease.
3. Parkinson's Disease: Causes, Symptoms, and Treatments.


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