

Review Article

Dietary Requirements for Parkinson's Disease-A Review

AR. Mullaicharam¹, K. Senthil Kumari², P. J. Joseph Francis¹, Mr. Maheswaran³

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Corresponding Author:

* Dr. AR. Mullaicharam,

Oman Medical College, Muscat, Oman.



ABSTRACT

Parkinson's disease is a gradually growing abnormality of the CNS (central nervous system). There is no definite causation and cure for this disease is known till date. It is a chronic disease and it mainly affects that portion, which is associated with the movement. There is no known remedy till date that can cure Parkinson's disease (PD). The changing diet protocols for Parkinson's disease works by restoring the normal biochemical level of the human body and also to promote good and healthy lifestyle. The most promising approach appears to be the use of antioxidants to slow the oxidation and damage to the substantia nigra. The most excellent diet guidance for most people with Parkinson's to have the right balance of nutrients from different food groups. That can be achieved by eating a well balanced diet, which will provide adequate levels of vitamins and minerals. It's possible that additional nutritional approaches may be found in the future.

*Email Id-mullaicharam@yahoo.com

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1 Oman Medical College, Muscat, Sultanate of Oman.

2 Oman Nursing Institute, Sultanate of Oman.

3 Jaya college of Pharmacy, Tamil Nadu, India.

INTRODUCTION

Parkinson's disease foundation, ⁽¹⁾ reported the following outcomes.

As many as one million Americans live with Parkinson's disease (PD), which is more than the combined number of people diagnosed with multiple sclerosis, muscular dystrophy and Lou Gehrig's disease.

Approximately 60,000 Americans are diagnosed with Parkinson's disease each year, and this number does not reflect the thousands of cases that go undetected.

An estimated seven to 10 million people worldwide are living with Parkinson's disease.

Incidence of Parkinson's increases with age, but an estimated four percent of people with PD are diagnosed before the age of 50.

Men are one and a half times more likely to have Parkinson's than women.⁽¹⁾ The foundation also reported that the combined direct and indirect cost of Parkinson's, including treatment, social security payments and lost income from inability to work, is estimated to be nearly \$25 billion per year in the United States alone. Medication costs for an individual person with PD average \$2,500 a year and therapeutic surgery can cost up to \$100,000 dollars per patient.⁽¹⁾

The cardinal symptoms associated with Parkinson's disease are:

- Tremor
- Rigidity
- Akinesia / bradykinesia
- Postural instability

Secondary symptoms associated with Parkinson's disease include:

- Drooling
- Freezing
- Reptilian stare
- Insomnia/Excessive somnolence
- Dementia
- Speech and swallowing disturbances
- Constipation
- Depression
- Excessive sweating
- Scaling, dry skin on the face and scalp
- Slow response to questions
- Small, cramped handwriting
- Soft, whispery voice

Reason for Parkinson's disease:

This disease discovered by James Parkinson in the year of 1817. It was before known as Kampavata (Kampa: tremor; Vata: the bodily humor governing movement) in ancient Ayurvedic texts. The Charaka Samhita, the most ancient and authoritative textbook of Ayurveda, gives the following description of the symptoms of Kampavata (Parkinson's): 'Tremors of hands and feet; difficulty with body movements'. Various signs and symptoms currently associated with the disease such as akinesia, drooling, reptilian stare, tremor, constant somnolence, rigidity and dementia are also described in the Caraka Samhita.⁽²⁾

As per Allopathic view, Parkinson disease is a slowly **progressive, neurodegenerative disorder** that occurs when certain nerve cells called neurons, in the area of the brain identified as the **substantia nigra**, die or become impaired. Normally, these neurons produce a vital substance known as **dopamine**. Dopamine is the chemical messenger responsible for transmitting signals between the substantia nigra and the next "relay station" of the brain, allowing smooth, coordinated function of the body's muscles and movement.

The four main motor symptoms of PD are:

- Shaking or **tremor**
- Slowness of movement, called **bradykinesia**
- Stiffness or **rigidity** of the arms, legs or trunk

- Trouble with balance, also called *postural instability*⁽³⁾

The cause of Parkinson's disease is that it evolves as the concentration of dopamine in the substantia nigra decreases, and concludes that Parkinson's symptoms become evident when the concentration of dopamine begins to drop below 20% of the normal level. As part of the decrease in dopamine concentration, the post-synaptic receptors within the caudate nucleus and the putamen develop hypersensitivity, therefore in Parkinson's disease; the dopamine receptors are hypersensitive simply because the concentration of dopamine has decreased. The basal ganglia control movement by two balance systems, one cholinergic and other dopaminergic, in which the chemical transmitter is dopamine. In Parkinson's disease, the dopaminergic system is defective and the cholinergic system is dominant, and gradually the features of Parkinson's disease become visible. Given this as the Allopathic rationale for the cause of Parkinson's disease, it would seem that the proper re-introduction of dopamine to the brain would be an effective cure, which it is has not proven to be.⁽⁴⁾

Levodopa is the Primary Western medicine for Parkinson's disease. Levodopa produces strong side effects that include:

- Cramps
- Nausea
- Hypotension
- Constipation
- Lack of bladder control
- Interference with memory
- Emotional anxiety
- Changes in blood pressure
- Explosive diarrhea
- Dry itchy skin
- Dry eyes
- Intermittent effects which interfere with movement

Ayurveda explains that the cause of Parkinson's disease, a disorder caused by imbalance of the Vata Dosha, is the presence of aggravated air in the brain. This aggravated air is formed as a result of poor digestion leading to disturbance of the stomach, and the stomach then sends aggravated, unhealthy air to the brain. Over time the aggravated air attacks and corrodes the area of the brain that controls involuntary movements. This corrosive effect on that area of the brain results in the Parkinson's symptoms.⁽²⁾

Relation between food and Parkinson's disease

Therefore cure of Parkinson's disease is the process of exchanging the aggravated air in the brain for clean and nutritive air, generated by the now properly functioning stomach. The apparent long-term treatment of Parkinson's by Ayurveda is due to the delicacy of creating a climate in which the toxic airs can be eliminated while fresh and wholesome airs are re-introduced. The process of healing is accelerated by strictly following diet, abstinence from intoxicants and undesirable life practices, for the simple reason that these factors are what contributed to the Parkinson's patient being afflicted by the disease.⁽⁵⁾

The Central India Institute of Medical Sciences (CIIMS) Diet consultant and nutritionists reported that Food emerges as the best tool to manage the Parkinson's disease. The management plan for food definitely cannot cure or slow the progression of the disease but can ensure better quality of life.⁽⁶⁾ It is also reported that the medical treatment of the disease itself can have many health effects. It can slow the gastrointestinal tract, source constipation and can also sluggish the stomach emptying and swallowing problem. It can lead to loss of smell and taste. Parkinson's medicines can cause nausea and loss of appetite. One of the most important medications 'L-dopa' competes with proteins for absorption from the small intestine.⁽⁶⁾ People with Parkinson disease are at increased risk for undernourishment. With attention on to the diet, patients feel better and can ward off nutrition-related problems. But Parkinson disease affects each individual differently. Also medications for other diseases like heart, blood pressure, diabetes which the Parkinson patient may also be suffering from too can have a bad impact on the patient.⁽⁶⁾

Types of food requirements for Parkinson's disease patients ^(7,8,9)

CHO and PD

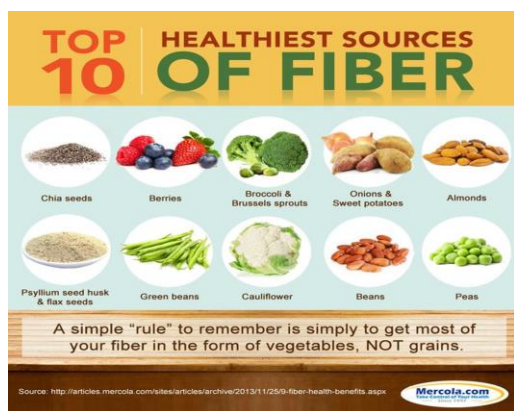
The PD patient's requires 55 to 60 percent of the calories in their diet through CHO which help levodopa absorption. Use of dietary CHO increases the release of insulin and indirectly lower blood levels of neutral amino acids.

Fat and PD

High fat intake slows down the gastric emptying which leads to decrease the effectiveness of Sinemet for Parkinson's disease. From total caloric intake fat should not exceed 30 percentages

Fiber and PD

There is a bowel impact for those patients. Parkinson can slow the movement of colon causing constipation. Foods rich in fiber, roughage and enough fluids (buttermilk, lime water, vegetable soup) can evacuate the bowel which can prevent the constipation. Since adequate dietary fiber intake prevents constipation, it is must to take fruits and vegetable at least 4 - 5 servings along with whole grains.



Rank	Fruit	Quantity	Fiber (g)
1	Avocado, flesh	1 cup	10.10
2	Durian, flesh	1 cup	9.20
3	Guava	1 cup	8.90
4	k.i.w.i	1 cup	5.00
5	Oranges	1 cup	4.30
6	Pear	100 gram	4.00
7	Grape (red colour)	1 cup	4.00
8	Ba-na-na	1 cup	3.90
9	Mango	1 cup	3.00
10	yA-yA-PA-PA-YA	1 cup	2.50

Water and fluids

Levodopa increases the risk of dehydration which can lead to confusion, weakness, balance problems, respiratory failure, kidney failure and even death. The patients has to drink enough fluid with salt and honey (if non-diabetic) in buttermilk, lime water, vegetable soup, ambul jaljeera, panha and coconut water kokum. Also Parkinson's disease patients need to drink 6 -8 cups of non caffeinated fluids.

Supplements (Calcium, magnesium, vitamin B6, vitamin D and vitamin K, potassium and other minerals)

This disease leads to bone thinning for both men and women which is one of the high risk factor for Parkinson's disease. Undernourishment and weight loss increases the risk for bone fracture and other disabilities as the disease progresses. Possibility of falls also increases. The bone-strengthening meals like Calcium, magnesium, vitamin D and vitamin K are regular requirement for Parkinson's patients. Also regular exposure to sunlight is vital as it provides vitamin D. Weight-bearing exercise such as walking is important to prevent fractures and hospitalization. High intake of potassium and other minerals through vegetable and fruits helps the PD patient to reduce the abdominal bloating and edema.



Limitations in intake of vitamin B6 and sodium

It was found that vitamin B6 prevented the absorption of the levodopa, so people were advised not to eat foods rich in B6, or to take B6 supplements. Now, however, the medication commonly used combines carbidopa or benserazide with the levodopa. These “protect” the levodopa, so that vitamin B6 in reasonable amounts is no longer thought to be a problem. It’s generally recommended that vitamin supplements for people using carbidopa-levodopa or benserazide-levodopa contain no more than about ten-fifteen milligrams of B6 daily; some people can tolerate more than that, others may be more sensitive. If you are sensitive to B6, or if you need to take very large amounts (over 15 mg), take the B6 at least two hours apart from the levodopa. Food sources of B6 include chicken, fish, pork, eggs, brown rice, soybeans, oats, whole wheat, peanuts, and walnuts, also fortified products such as cereals.

Weight loss

Patients lose weight due to nausea, loss of appetite, depression and slow movement. The weight loss along with malnutrition weakens the immune system, muscle wasting and also causes loss of vital nutrients and risks for other diseases⁽⁶⁾

Protein and levodopa interactions

This basic medicine competes with proteins of diet in absorption from the small intestine. Patients must take medicine 40-50 minutes before food. Another solution is that of low but good proteins. It can reduce daily fluctuations and make L-dopa therapy more effective.⁽⁶⁾

Herbs

In particular, herbs and spices for Parkinson’s disease are among the most researched.

Green tea

Other than aiding weight loss, fighting cancer, and helping with graceful aging, green tea shows signs of being able to help against Parkinson’s disease. Research by Dr. Baolu Zhao specifically indicates green tea’s polyphenols protect dopamine neurons.⁽¹⁾ In a similar study at the Seoul National University College of Medicine found that EGCG, the neuroprotective agent in green tea slashed the neuronal death rate by half when administered to mice.⁽⁷⁾

According to Dr. Baolu Zhao, corresponding and senior author on this article, current treatments for Parkinson's are associated with serious and important side effects. Their previous research has indicated that green tea possesses neuroprotective effects, leading Guo and colleagues to examine its effects specifically in Parkinson's. The authors discovered that green tea polyphenols protect dopamine neurons that increases with the amount consumed. They also show that this protective effect is mediated by inhibition of the ROS-NO pathway, a pathway that may contribute to cell death in Parkinson's. ⁽⁷⁾

Considering the popularity of green tea beverages worldwide, there is enormous public interest in the health effects of its consumption. John H. Krystal, M.D., Editor of *Biological Psychiatry* and affiliated with both Yale University School of Medicine and the VA Connecticut Healthcare System, reminds us that "many health-related claims have been made for a wide variety of naturally-occurring substances and many of these claims, as in the case of St. John's Wort and Ginko Biloba, have not held up in rigorous clinical studies. Thus, it is extremely important to identify the putative neuroprotective mechanisms in animal models, as Guo and colleagues have begun to do for Parkinson's disease."

Dr. Zhao's hope is that eventually "green tea polyphenols may be developed into a safe and easily administrable drug for Parkinson's disease." Dr. Krystal agrees, that "if green tea consumption can be shown to have meaningful neuroprotective actions in patients, this would be an extremely important advance."⁽⁷⁾

Turmeric

The research in Michigan State University (Basir Ahmad)⁽³⁾ found that curcumin, a compound of turmeric, may help fight Parkinson’s disease by disrupting proteins responsible for the disease and preventing said proteins from aggregating.⁽⁸⁾

α -Synuclein aggregation is involved in, and likely the cause of, Parkinson disease⁽⁸⁾. Although α -synuclein is commonly thought of as intrinsically disordered, a recent report demonstrated that, in human cells, it exists in a helical tetramer that does not easily aggregate.⁽⁸⁾ This suggests that the physiological pathway for aggregation is first unfolding of the tetramer to kinetically trapped monomers and then reassociation to a disordered aggregate and eventually fibrillar Lewy bodies. Therefore, preventing reassociation of the monomers is a useful therapeutic strategy. Many researchers in the past several years have investigated the interaction of potential aggregation inhibitors with oligomers of various sizes and fibrils, but there have been few observations of inhibitors with monomers, primarily because spectroscopic detection is difficult⁽⁹⁻¹³⁾.

We have recently investigated the chain dynamics of disordered monomeric α -synuclein under a variety of aggregation conditions and found that the internal reconfiguration rate (or the rate of intramolecular diffusion) is fast under conditions in which aggregation is inhibited and slows when aggregation is more likely⁽¹³⁾.

Curcumin, a compound found in the spice turmeric, has been shown to have many medicinal properties and inhibits aggregation of the Alzheimer amyloid- β peptide.⁽¹⁴⁾ In α -synuclein, curcumin has been shown to inhibit fibril formation and increase solubility, but the physical basis of the aggregation inhibition is not known.⁽¹⁵⁾ We found that curcumin strongly bound to the monomer and completely inhibited aggregation, and with curcumin, intramolecular diffusion of α -synuclein was increased by >10-fold at 40 °C compared with the protein alone^(16,17)

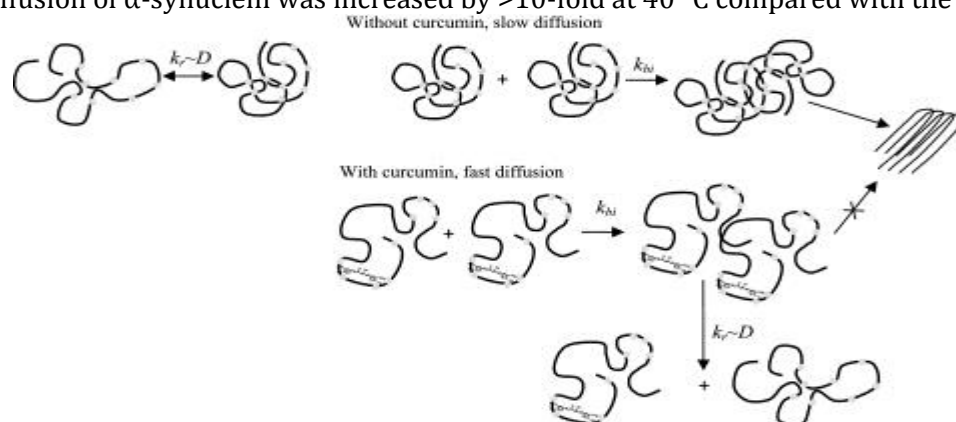


Fig. 1. Schematic representation of curcumin action on α -synuclein showing bimolecular association and subsequent aggregation steps.

Ginkgo Biloba

Ginkgo remains a potentially beneficial herb for Parkinson's sufferers. In a 2012 study at the National Institute of Neurology and Neurosurgery in Mexico, a patented extract of ginkgo leaves were dispensed to animal models of Parkinson's.⁽⁴⁾ The extract showed neuroprotective and neurorecovery effects against midbrain dopamine neuron damage and even damage to locomotion. Researchers declared, "These studies suggest it as an alternative in the future treatment of PD."⁽¹⁸⁾

Ginkgo Biloba extract 761 (EGb 761) is a patented and well-defined mixture of active compounds extracted from Ginkgo biloba leaves. This extract contains two main groups of active compounds, flavonoids (24%) and terpenoids (6%). EGb 761 is used clinically to treat dementia and vaso-occlusive and cochleovestibular disorders. This extract has neuroprotective effects, exerted probably by means of its antioxidant function. Parkinson's disease (PD) is a neurodegenerative disorder that affects 2% of the population older than 60 years.⁽¹⁸⁾



1. Ginkgo Biloba For Parkinson's Disease

Brahmi

Also known as Bacopa, this Ayurvedic herb is often used in the United States as water plants in aquariums. Some practitioners like Ray Sahelian, MD, advocate its use as a memory enhancement as it has been used for centuries in India. According to University of Maryland Medical Center studies, brahmi may improve circulation to the brain and even protect brain cells. Another study by Pennsylvania State University College of Medicine applied brahmi seed powder to rodent models of Parkinson's. Results showed promise in conquering the disease and protecting the brain from damage.



Cowhage

Cowhage is commonly referred to as the "velvet bean." The Latin name for the plant is *Mucuna pruriens*. "Cowitch," "donkey eye," and "kapikachu" are less common names. It grows abundantly in tropical and subtropical regions of the world and is native to southern China and eastern India. A popular herb in India, cowhage, or kapikachu, is found in bushes of lowland forests throughout the country. It drew attention of the University of Maryland Medical Center, which speculated that cowhage, which contains levodopa or L-dopa, might perform better than L-dopa administered as a drug against Parkinson's disease.

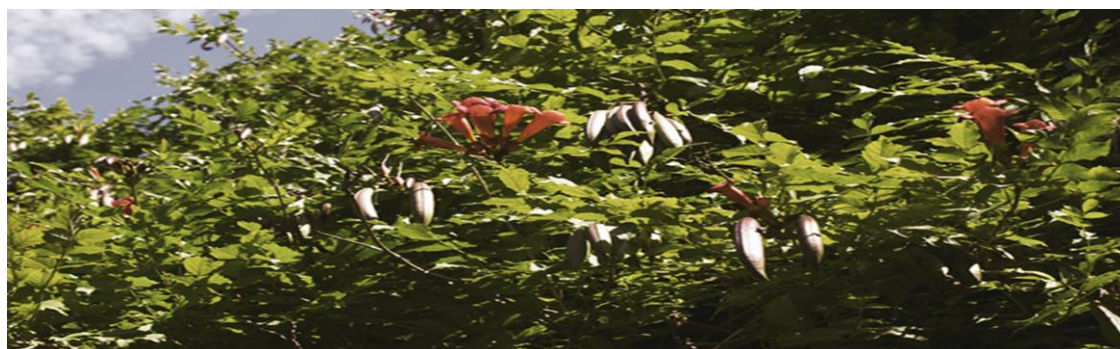


Table 1 lists diets and food reported along with PD⁽¹⁵⁾

DIETS, FOODS AND PARKINSON	EFFECTS OBSERVED	TYPE OF STUDY	AUTHORS
Excessive alimentary intake (overweight, adiposity)	Increased incidence	Statistical	Palacios (19)
Low protein intake	Improvement	Clinical	Mena (20)
Protein redistribution	Improvement	Clinical	Cereda (21)
Exclusion of red meat	Improvement	Clinical	Coimbra (22)
Meat meals	Aggravation	Clinical	Langan (23)
Animal fat	Increased incidence	Statistical	Anderson (24)
Blubber and pilot whale meat	Increased incidence	Statistical	Petersen (25)
Sheep meat	Increased incidence	Statistical	Komatsu (26)
Dairy products intake by males	Increased incidence	Statistical	Ishihara (27)
Quasi vegan diet	Improvement	Clinical	Schwartz (28)
Restricted diet low animal fat no fat milk products	No improvement	Clinical	RenouDET (29)
Plant protein diet	Improvement	Clinical	Baroni (30)
Horse bean, broad bean, faba bean (<i>Vicia faba</i> l)	Improvement	Clinical	Rabey (31)

Velvet bean (<i>Mucuna pruriens</i> l) dc. var. utilis	Improvement	Clinical	Katzenschlager (32)
Coffee (<i>Coffea arabica</i> l) infusion of roasted seeds	Lower incidence	Statistical	Ishihara (27)
Tea (<i>Camellia sinensis</i> l) infusion of leaves	Lower incidence	Statistical	Tanaka (33)
Soybeans (<i>Glycine mas</i>) cooked seeds	Lower incidence	Statistical	Fukushima (34)
Corn (<i>Zea mays</i> l) seeds	Lower incidence	Statistical	Fukushima (34)
Tomatoes (<i>Lycopersicon esculentum miller</i>) fruits, sauces	Lower incidence	Statistical	Nielsen (35)
Potatoes (<i>Solanum tuberosum</i> l), tubercles	Lower incidence	Statistical	Nielsen (35)
Vegetables, green, yellow and others	No material relationship	Statistical	Miyake (36)

Green Tea

The authors discovered that green tea polyphenols protect dopamine neurons that increases with the amount consumed. They also show that this protective effect is mediated by inhibition of the ROS-NO pathway, a pathway that may contribute to cell death in Parkinson's disease.⁽⁷⁾

General nutrition needs for PD

The Food Guide Pyramid can be adapted for use as a general guide to nutrition for those with PD.

Scientists have shown that a diet rich in fruit, vegetables, legumes, whole grains, nuts, fish, and poultry and a low intake of saturated fat and a moderate intake of alcohol may protect against PD --- in other words the more fruit, veggies, beans and fish you eat the lower your risk for PD. Some scientists call this sort of diet (add a splash of garlic and a glass of red wine!) the 'Mediterranean diet' because it is generally what people eat when they live around the Mediterranean Sea.⁽³⁷⁾

So we must adapt the Food Guide Pyramid to obtain the best food choices to combat PD.

Vegetables and fruits provide the antioxidants, phytochemicals, minerals, and vitamins that nourish and support the muscles, nervous system, and organs of the body. Calcium is particularly important, as it helps keep the bones strong, preventing fractures. And protein keeps the muscular system healthy; strong, toned muscles help to maintain balance and strength.



Mediterranean Diet Pyramid

In many studies, both in animal models and humans, demonstrated the pomegranate as one of the most powerful fruits enriched with high antioxidants and minerals and vitamins.⁽³⁸⁾ The fruit also helps to prevent or treat many pathophysiological conditions without any side effect.

Vanillin, a phenolic compound, has been reported to offer neuroprotection against experimental Huntington's disease and global ischemia by virtue of its antioxidant, anti-inflammatory, and antiapoptotic properties. Vanillin may serve as a potent therapeutic agent in the future by virtue of its multiple pharmacological properties in the treatment of neurodegenerative diseases including PD⁽³⁹⁾. In this reference, we have shown that chronic dietary supplementation of date palm fruits grown in Oman showed possible beneficial effects concomitant with oxidative stress reduction and increased antioxidant enzymes in AD transgenic mice model⁽⁴⁰⁾.

Edible items and natural products rich in antioxidants could offer benefit to neurodegeneration.

Mitochondrial dysfunction and oxidative stress-mediated apoptosis plays an important role in various neurodegenerative diseases including Huntington's disease, Parkinson's disease (PD) and Alzheimer's disease (AD). 1-Methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP), the most widely used neurotoxin mimics the symptoms of PD by inhibiting mitochondrial complex I that stimulates excessive intracellular reactive oxygen species (ROS) and finally leads to mitochondrial-dependent apoptosis.

Lutein, a carotenoid of xanthophyll family, is found abundantly in leafy green vegetables such as spinach, kale and in egg yolk, animal fat and human eye retinal macula. Increasing evidence indicates that lutein has offers benefits against neuronal damages during diabetic retinopathy, ischemia and AD by virtue of its mitochondrial protective, antioxidant and anti-apoptotic properties⁽⁴¹⁾. Asiatic acid (AA) is a triterpene extracted from *Centella asiatica* has been reported as an antioxidant and anti-inflammatory agent, that offers neuroprotection against glutamate toxicity⁽⁴²⁾.

Date palm fruits are a good source of dietary fiber and are rich in total phenolics and natural antioxidants, such as anthocyanins, ferulic acid, protocatechuic acid and caffeic acid. These polyphenolic compounds have been shown to be neuroprotective in different model systems⁽⁴³⁾.

Pomegranates contain very high levels of antioxidants and several medicinal properties that may be useful for improving quality of life in individuals with Alzheimer's disease ⁽⁴⁴⁾. The studies shows, the effects of the antioxidant-rich pomegranate fruit grown in Oman on brain oxidative stress status were tested in the Alzheimer's disease transgenic mouse. The results suggest that the therapeutic potential of 4% pomegranate in the treatment of Alzheimer's disease might be associated with counteracting the oxidative stress by the presence of active phytochemicals in it⁽⁴⁵⁾. Recent clinical research has demonstrated that berry fruits can prevent age-related neurodegenerative diseases and improve motor and cognitive functions.

The berry fruits are also capable of modulating signaling pathways involved in inflammation, cell survival, neurotransmission and enhancing neuroplasticity. The neuroprotective effects of berry fruits on neurodegenerative diseases are related to phytochemicals such as anthocyanin, caffeic acid, catechin, quercetin, kaempferol and tannin⁽⁴⁶⁾.

In one of the study concludes that figs could improve memory related behavioral deficits, reducing the A β and oxidative damage and enhancing the antioxidant system in AD transgenic mice. Protection from A β mediated oxidative damage in brain could be potentially considered as a promising strategy for therapeutic intervention in Alzheimer's disease ^(47,48).

Numerous studies indicating that natural plant sources and their active phytochemicals offer protection to the pathological processes related to the development of neurodegenerative diseases including Parkinson's disease (PD). In one of the study⁽⁴⁹⁾, the neuro protective efficacy of dietary supplementation of walnut (6 %) for 28 days was examined in 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) (i.p., 20 mg/kg body weight/day) for last four consecutive days. MPTP injection diminished the levels of GSH, dopamine and metabolites along with decreased activities of GPx and mitochondrial complex I. Further, the levels of TBARS and enzymatic antioxidants such as SOD and catalase, MAO-B activities were enhanced by MPTP treatment. Behavioral deficits and lowered TH expression are also proved MPTP induced neurotoxicity. Dietary supplementation of walnut attenuated MPTP-induced impairment in PD mice might be by its MAO-B inhibitory, antioxidant and mitochondrial protective actions. Also in one of the study the findings suggest that dietary supplementation with walnuts may have a beneficial effect in reducing the risk, delaying the onset, or slowing the progression of, or preventing Alzheimer's disease ⁽⁵⁰⁾. Rotenone a widely used pesticide that inhibits mitochondrial complex I has been used to investigate the pathobiology of PD both in vitro and in vivo. Studies have shown that the neurotoxicity of

rotenone may be related to its ability to generate reactive oxygen species (ROS), leading to neuronal apoptosis⁽⁵¹⁾.

CONCLUSION

A balanced nutrition is important for everyone and particularly it plays a major role Parkinson's disease (PD). In general, a healthy diet can increase energy, maximize the potential of medications, and promote overall well-being.

A single diet pattern cannot treat Parkinson's disease or its symptoms, but a healthy and balanced diet can improve general well-being. Eating fruits and vegetables may help to keep energized and hydrated. Fiber-rich foods and fluids may ease symptoms of constipation or low blood pressure.

The diet may have significant impact on the medication regimen. Adjusting the timing and composition of meals might allow medications to work better and better to avoid specific foods to prevent side effects.

This chapter will give the brief idea about the role of carbohydrate, protein, and fat for Parkinson's patient. Also the chapter explains the role of supplements, herbs and various recipes required for PD patients.

Conflict of Interest: None

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