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Chapter - 4

Role of Fruits in Parkinson's Disease

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Chapter - 4

Role of Fruits in Parkinson's Disease

Dr. M.R. Suchitra and Dr. S. Parthasarathy

Abstract

Parkinson's disease is a common neurological disease of the elderly affecting around 5.8 lakh people in India. The pathophysiology and management of the same have not been fully unravelled to have full control of the disease. The decrease in neuronal dopamine and the setting up of an inflammation to cause degeneration in the nigrostriatal pathways are proposed as the causative factors. Adequate dietary modifications have been suggested to arrest the progress of the same. Fruits with action on various chemicals and various antioxidant effects have been described. Berries and avocados possess L Dopa and found to be useful. They also have poly unsaturated fatty acids (PUFA) which are directly implicated in the regression of symptoms. The antioxidant and anti-inflammatory effects of grape juice and extracts of grape fruits are beneficial in postponing the onset of the disease. There are a lot of fruits like apples, custard apples, plums with catechins which have got antiparkinsonian effects. Fig fruit extracts have been described to stop the mitochondrial dysfunction which is the common lethal pathway to deposit lewy bodies in the specific sites of the brain. There are a few apprehensions about fruit intake and Parkinson's because of pesticide effects. Hence, a fruit a day without pesticides can be a dietary supplement to drugs in the management of Parkinson's disease.

Keywords: degeneration, disease, diet, fruits, neurology, parkinson's

Introduction

Parkinson's disease is a chronic disorder of the central nervous system which affects small designated areas in the brain that control posture, movement and balance. It is a complex neurological disease with diverse symptoms. Tremors, loss of balance, rigidity and mild decrease in the power of the muscles form part of the symptom complex of Parkinsonism. There may be autonomic involvement also. The prevalence of the disease in India is around 5.8 lakh people ^[1]. The pathophysiology of the disease is linked to

defective dopamine secretion in the basal ganglia. The first studies implicated the role of L Dopa in the pathogenesis of the disease. Even though there are many drugs to control the symptomatology, there is no established cure in these patients. The unexplored neuro biochemistry in its pathophysiology has stalled the progress of drug inventions. In such a clinical management scenario, the role of diet and nutrition will have a lion's share in the control of the disease. Diet and Parkinson's disease have been explained in detail by many authors [2, 3]. The practice of following a described and prescribed diet for the purpose of control of the disease is difficult. Hence, eating a fruit, a day may be a simple alternative. Hence in this small conceptual review, we have tried to identify different fruits and link their phytoconstituents on their possible neuro modulation of Parkinson's disease.

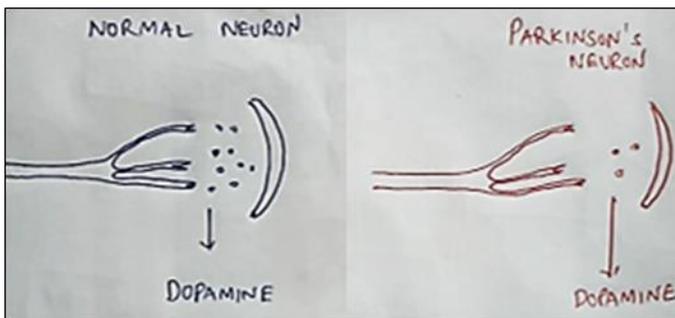


Fig 1: Pathophysiology of Parkinson's disease

Pathophysiology of parkinson's disease

James Parkinson, in 1817, a London based physician described a shaking palsy of the elderly termed as Parkinson's disease. The evolution in decades has invented the involvement of dopamine, acetylcholine and a few other neurochemicals. The target drugs have been identified: but the breakthrough in the cure is still not completely achieved. Basically, there are three types of Parkinson's disease described. The classical idiopathic parkinsonism is called Parkinson s disease. The second one is the parkinsonian syndromes associated with other diseases like Shy Dragger and Wilsons syndromes. The third one is similar symptomatology produced by toxins and drugs. There are only a few described movement disorders in the elderly. Among these diseases, Parkinson's disease is a common clinical entity. There is a characteristic loss of dopaminergic fibres usually present in the basal ganglia. This deficit causes a depletion of regional dopamine concentrations in these specific sites. Dopamine is presumed to decrease the rate of firing of the neurons of the extrapyramidal motor system. This causes a symptomatology specific of

decreased dopamine and increased acetyl choline. The three features are bradykinesia (decreased movement), tremors at rest and muscle rigidity. The concentrations of chemicals; 3,4-dihydroxyphenylacetic acid and homovanillic acid, are decreased in the caudate nucleus and putamen. Obviously, the treatment of Parkinson's disease is targeted either to increase the concentration of dopamine in the basal ganglia or to attenuate the neuronal effects of acetylcholine. L dopa alone or a combination with carbidopa is being used for the treatment of Parkinson's disease. Selegiline, a monoamine oxidase inhibitor, by increasing the dopamine levels in the basal ganglia is also used. The non-competitive N-Methyl D-Aspartate receptor antagonist memantine has shown advantage in curtailing motor deficits of Parkinson's disease, with a special reference to akinesia. Apart from dopaminergic and cholinergic systems, serotonergic, glutamatergic, γ -aminobutyric acidergic, and endocannabinoid neurotransmission systems have been implicated in the modulation of progress of the disease. There is a recent research by Trivedi *et al.* in which they suggested that new biomarkers secreted in the sebum of individuals suffering from Parkinson's disease can be smelt and diagnosed [4]. Such excess can be targeted to treat the disease. Research is in progress to identify the role of individual chemicals and the efficacy of using them to cure the disease. The exact cause of the neuronal loss in the brain in this disease is unclear. But recent findings support the hypothesis that pathological changes may spread from the intestinal tract to the brain through the tenth cranial nerve. The possible pathophysiology which are delineated are oxidative stress, mitochondrial dysfunction and abnormal aggregation of alpha synuclein. A subtle chronic inflammation may also play a role in its worsening because of increased synuclein. Considering the dietary role, foods which are identified to be associated with reduced disease progression included fresh vegetables and herbs, fresh fruit, nuts and seeds, olive oil, coconut oil, fresh herbs, and spices. Fried or canned foods and fast foods are associated with increased risk. Omega-3 Poly Unsaturated Fatty Acids serve as energy substrates and play a critical role in maintaining neurobiological functions, without much disturbance [5]. Numerous polyphenols like, resveratrol, anthocyanins flavins, catechins and curcumin may have neuro-protective and a possible therapeutic potential in Parkinson's disease [6]. A number of vitamins including D, E and B are being described to decrease the severity of the disease.

Fruits and neuromodulation

There are a number of described fruits with a definitive action on the central nervous system.

Avocados and berries

Avocados, raspberries, straw berries and other berry fruits have PUFA activity. Even though vegetable oils and seeds form a major source of dietary PUFA, the fruits can be an alternate source where the taste matters. All the above-described fruits contain 0.1 gram per 100 grams ^[7]. This looks like a miniscule portion of the PUFA intake, still we wanted to establish that fruits also can provide PUFA. Avocados have a high content of antioxidants with a potential neuroprotective effect ^[8]. Aging is the known major risk factor for neurodegenerative diseases such as Parkinson's diseases. Enough evidence state that oxidative stress is involved in the development of these diseases. Avocados are fruits with unique antioxidant effects, which preferentially subdues radical generation and hence they are promising as effective neuroprotective agents. Blackberry juice has been proved to be effective in decreasing the side effects of L dopa in Parkinson induced mice ^[9]. The potential has so far been not studied in human beings. The most abundant antioxidants in strawberry fruits are certain flavonoids including anthocyanins, catechin, tannins quercetin, vitamins C, E and carotenoids. After understanding the pathophysiology of Parkinson's disease and the phytochemistry of strawberry fruits, a clear link of the usefulness of this fruit is evident. Bilberries provide significant neuroprotective health benefits due to their high levels of anthocyanins, flavonols, vitamins C and Vitamin E ^[10]. These fruits also contain high levels of manganese and carotenoids. Anthocyanins are the major group of polyphenols in blackcurrant fruits. They account for around 80% of the total amount of quantified compounds. The modulation of anthocyanins is one of the described pathophysiological bases of Parkinson's disease. Seidl *et al.* have described the protective effects of (Docosahexaenoic acid), DHA. They have stated that they are mediated by a metabolic derivative known as neuroprotectin D1. This D1 protects neurons against oxidative stress thereby preventing the disruption of the cytoskeleton ^[11].

Citrus fruits

In a study, extracts of grape skin improved muscle function and extended the lifespan of flies with Parkinson's disease. This specific neuroprotective effect of grape skin extract was due to its potential to rescue mitochondria from the defects caused by the neurodegenerative disease. In a study, grape juice intake decreased the rotations of Parkinson's in wistar rats ^[12]. Regarding citrus fruits, a lot of potential therapeutic benefits are beginning to come up. Nobiletin, a flavonoid identified in the peel of the citrus fruit, was found to improve artificially evoked motor and cognitive deficits in mice. Such

antioxidant and anti-inflammatory effects of nobiletin and tangeretin (flavonoids of citrus fruits) are well known ^[13]. But additionally, they have been shown to decrease cholinergic deficits, and reverse N-methyl-D-aspartate (NMDA) receptor hypofunction. These two actions are the clinical targets in patients with Parkinson's disease.

Apple/Custard apple

Gao *et al.* have demonstrated that regular intake of fruits like apple with flavonoids decreased the progress and postponed the onset of Parkinson's disease ^[14]. Bananas and apple are known to increase L tyrosine and dopamine. Whether this transforms into clinical use in Parkinson's disease is not yet established. Custard apple or the sitaphal has adequate flavonoids like catechin and epicatechin whose deficiency are important in the pathogenesis of the disease ^[15]. Even though sitaphal has many potential uses including anti-cancer effects, the abundance of catechin can put it into the brackets of antiparkinsonian therapy. Among foods high in catechins are some fresh fruits described below. Large concentrations of catechins per serving will be present in apples, black grapes, apricots, cherries, berries and peaches.

Miscellaneous

Ciulla M *et al.* have studied the effects of Mango fruits and their flavonoid ingredients in the fruit and found to be useful as a dietary supplement in the control of the disease ^[16]. Watermelon is full of polyphenols, antioxidants, anti-inflammatory chemicals including vitamin C. These ingredients are essential in blunting the progress of the disease. The fruit also can stop neuro degeneration which is the corner stone of anti-Parkinson therapy ^[17].

One study on the effect of fig fruit extracts on Parkinson's disease has demonstrated that such extracts decreased mitochondrial dysregulation thereby helping to decrease the progress of the disease ^[18]. The next option could be a development of a novel therapeutic anti Parkinson molecule from such fruit extracts.

Strathearn KE *et al.* have described that dried and fresh plums have enough anthocyanins as chemicals which can stop neuro degeneration in Parkinson's disease ^[19]. Scientists have metabolically engineered a tomato enriched in levodopa; These tomatoes could represent a, low-cost useful alternative L-DOPA source for Parkinson's patients, particularly those in developing nations like India where treatment and medical cost is prohibitive ^[20]. Kujaswka *et al.* have studied the effects of pomegranate juice extracts in rotenone induced Parkinson's disease and found a beneficial effect of the juice. They suggested that ellagitannins-derived chemical urolithin A may be the active compound responsible for the effect ^[21].

Olive oil comes from olives fruits obtained from the olive tree. They are the traditional crop of the Mediterranean region. A few studies have found the usefulness of olive oil in the prevention of both Parkinson's disease and Alzheimer's disease [22]. But it is not common to take olive fruits as such and hence discussion of such fruits for the prevention is not detailed. The role of autophagy in the genesis of Parkinson's disease has been established [23]. Any reduction of autophagy is likely to promote neuro degeneration and intermittent fasting with fruit intake is likely to benefit in terms of arrest of progression of disease [24]. A general overview of the pathophysiology of Parkinson's disease and possible targets in its control by fruit intake is pictured in fig 2. Even though there are a few unestablished reports of linking fruits with Parkinson's disease, they are linked with pesticide intake [25].

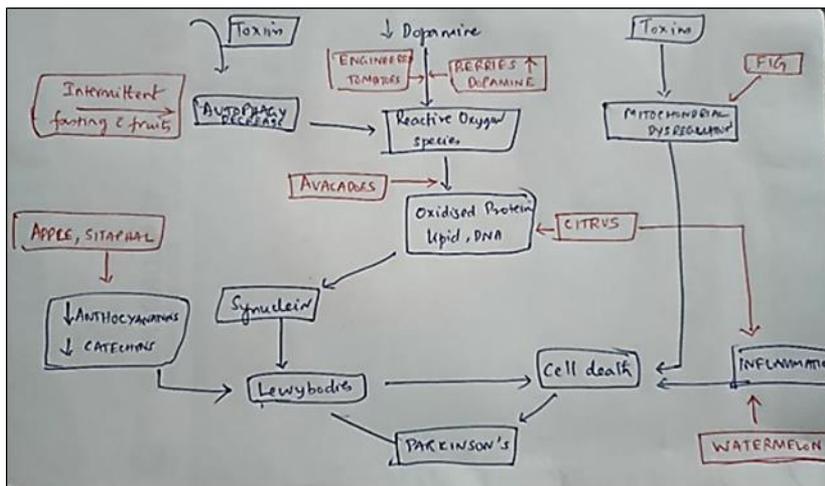


Fig 2: Possible targets in control of Parkinson's disease by fruit intake

Conclusion

Parkinson's disease is a chronic neuro degenerative disease with neural inflammation associated with depleted dopamine in the nigrostriatal pathways of the brain. Increasing dopamine and decreasing oxidative damage are projected to decrease the symptoms of the disease, Fruits such as berries and avocados along with apple and custard apple can decrease the progression of the disease. There are a few more fruits like citrus and pomegranate with flavonoids and chemicals which can be beneficial. We suggest a daily intake of different types of fruits with a special drive for berries and citrus fruits. The intake of such fruits can be a natural supplement to pharmacological agents in the control of Parkinson's disease.

Conflict of interest: Nil to both the authors.

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