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Nutraceuticals: A New Era of Medication

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Abstract

One of the most important healthcare challenges in the world today is neurological disorders.Nutraceuticals are substances derived from food that are thought to be good for human health. It is crucial for controlling brain physiology, preventing neurodegeneration, and maintaining cognitive function. Given how commonly used they are for enhancing health status, nutraceuticals have recently attracted the attention of numerous scientists. Especially for the avoidance or minimization of side effects in the prevention and treatment of various neurological diseases or disorders.A number of studies on functional foods have been started recently in an effort to develop foods with higher therapeutic activity and fewer adverse effects. As a result, terminology like "Pharmafoods," "Medifoods," "Vitafoods," and "Medicinal foods" have influenced the definition of the phrase "functional foods." With a focus on clinical studies, the current study aimed to assemble all popular (major) nutraceuticals used to treat various neurodegenerative diseases (NDDs), such as Parkinson's disease (PD), Alzheimer's disease (AD), and Huntington's disease (HD). Nutraceuticals have been suggested as a preventative treatment for neurological treatments as a result of a relationship between dietary habits and lifestyle and neurodegeneration. Nutraceuticals have exhibited a variety of neuroprotective qualities, including the ability to reduce inflammation, oxidative stress, intracellular calcium excess, and mitochondrial dysfunction, acting at several biochemical and metabolic levels. These food-based methods are thought to target several pathways in a slow, more physiological way without having a significant negative impact.The most prevalent neurological movement condition in the world, Parkinson's disease (PD), is currently treated with pharmacological methods that are mostly symptomatic and frequently have unfavourable side effects.Nutraceuticals are substances obtained from whole-food sources that have therapeutic value. Their development has made it possible to use alternative methods to treat neurodegenerative disorders like Parkinson's disease. We will look at some of the significant efforts made to better understand the role of nutraceuticals in PD in this study. This study will help regular people choose better nutritional supplements, combined with traditional neuroprotective medications and altered lifestyle habits, to battle various NDDs.

Keywords: Nutraceuticals; Pharmafoods; Medifoods; Vitafoods; Medicinal foods; Neurodegenerative diseases.

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Introduction

A wide range of chronic disorders with a highly convoluted aetiology are included in neurological ailments [1].In the year 1989, Dr. Stephen de Felice invented the term "nutraceutical."The progressive degeneration or death of the neurons is a hallmark of neurodegenerative illnesses. Neuronal damage is the cause of neurodegenerative disorders. These illnesses are linked to gene mutations, an accumulation of aberrant proteins, an increase in reactive oxygen species, or the degeneration of neurons in a particular area of the brain.The identification of cellular and molecular targets that eventually leverage greater brain performance has been prompted by the tendency of brain functioning to decline with age due to neurodegenerative processes [2]. Neurodegenerative illnesses are thought to be more likely to affect people in Western countries who are between the ages of 70 and 79 than those in India, where the prevalence is 0.7%. The variation is mostly caused by varied eating and living habits depending on the ingestion of various substances.Since the dawn of time, people have relied on natural remedies and spices to treat a variety of illnesses, with amazing success [3].

Nutraceuticals are defined by the American Nutraceutical Association as a food or a food product with health-promoting qualities. They include dietary nutrient supplements, herbal goods, beverages, soups, vegetables, fruits, and processed foods, such as cereals [5]. They also include genetically modified foods. Vitamins, minerals, and amino acids make up the majority of nutritional supplements, but more than a thousand more probiotic substances have been discovered so far.

Indians, Chinese, Egyptians, and Sumerians are among the oldest civilizations to have provided proof of the usefulness of food products in medicine and the treatment of disease, a claim that has even been maintained by Ayurveda for 5000 years [6]. A nutraceutical is a functional food that has been proven to have health advantages independent of its nutritional value. Nutraceuticals are proving to be a successful management tool for a number of chronic conditions, including neurological disorders, according to the available data [7]. Despite the potential advantages of nutraceuticals, they still have several drawbacks, including inadequate bioavailability, poor brain permeability, metabolism, etc., which makes it difficult for them to have a positive impact [8].Throughout the prehistoric period, plants were used as a source of medicine for many different diseases all across the planet. By establishing connections between alternative medical practises including herbalism, apothecary, ethnopharmacology, and phytotherapy, the historical development of nutraceuticals can be tracked.

The term "nutraceuticals" was coined in 1989 by the New York institution for Innovation in Medicine, an educational institution, to spur research in the biomedical field quickly [13]. The advent of contemporary drug development and clinical trials, along with the function of pharmacists, were all prompted by the sensible use of medications. Indian history is recognised for having the ability to perform healing processes, including the Unani, Ayurveda (including Sushruta, Samhita, and Charaka), Ashtavaidya, and Siddha systems of medicine.

Neutraceuticals

Nutraceuticals are any dietary components (whole or partial) or a food product (purified food) that have health or medical benefits, such as the ability to prevent and treat disease.A food product or its secondary metabolites that may provide health advantages (to prevent or treat diseases) in a clinical context are now referred to as nutraceuticals.Nutraceuticals (complementary medicine) have been shown in numerous studies to have neuroprotective effects against a variety of NDDs by regulating energy metabolism, neuro-oxidative stress, and neuroinflammation, as well as by enhancing neurogenesis (improving NPC proliferation, growth factors, and neurotrophins) through a variety of signalling pathways.

Benefits of Nutraceuticals

The major benefits of nutraceuticals include lesser or no adverse effects.

- They help us to avoid taking medications.

- They are economically affordable, easily available and has multiple therapeutic effect.
- They increase the health value by improving medical condition of the individuals.
- They act on multiple pathways linked to the neuronal cell death.

Nutraceuticals and Its Categories

In non-specific biological therapies, nutritional supplements are utilised to treat everything from mild diseases to cancers that are extremely hazardous. They play a strong and widely recognised role in neuroprotection.

➢ *Food-Based Nutraceuticals or Traditional Nutraceutical*

This category comprises food items that are derived entirely from nature without being altered from their natural component state. These include foods that go beyond providing basic sustenance, such as fruits, vegetables, grains, meat, fish, eggs, and dairy.

➢ *Nutrients*

In the metabolic pathways, the principal metabolites of substances including minerals, fatty acids, vitamins, and amino acids have well-established nutritional characteristics. These nutrients offer various advantages in treating neurological problems when combined with animal and plant products. Nutrient planting can be utilised to stop brittle bones, increase haemoglobin, and improve muscle power and brain communication.

➢ *Herbals or Extract and Concentrates of Botanical product*

The combination of nutrition and herbal remedies has a great effect on problems linked to way of life, including mental health.Based on their antioxidant capacity, flavonoids, which comprise substances like psoralen, which is produced from parsley and also has carminative and diuretic effects, have been clinically demonstrated to protect diabetes, cardiovascular problems, and kidney abnormalities. Aloe vera, for example, has anti-inflammatory and dilating characteristics, making it useful in the healing of wounds, and ephedra has bronchodilator and vasoconstriction effects, making it useful in the treatment of bronchospasms.Soybeans and chickpeas are examples of non-carotenoid foods that help remove cholesterol. One of the most widely used substances in cooking is turmeric, which contains curcumin, a phenolic acid with the highest antioxidant and anti-inflammatory activity. Dietary supplements, particularly those high in antioxidants like green tea, ginger, cumin, etc., have demonstrated potential results in weight loss.

➢ *Probiotic Microorganisms*

The eminent scientist Metchnikoff is credited with coining the term "probiotic." With regard to the physiology of the stomach and intestines, they are quite beneficial. They help remove harmful organisms from the intestines and have antibiotic effects. A balanced diet promotes both physical and mental wellness.Consuming probiotics has revolutionised the way gastrointestinal diseases are treated. Following these findings, probiotics have also been introduced for use as dietary supplements, including probiotic beverages and pills. Therefore, modern probiotics are contested for their therapeutic effects and claim to be useful in treating all medical disorders, from diarrhoea to neurological conditions like depression and Alzheimer's. The probiotics may be therapeutically somewhat effective in people with impaired immune systems who are at high risk of infection.

➢ *Nutraceutical Enzyme*

Cells produce protein structures called enzymes or biocatalysts. They accelerate metabolic processes and are particularly helpful for gastrointestinal disorders such gastric reflux disease, constipation, diarrhoea, etc. They are quite affordable because they may be found in both plant and animal sources.Nutraceuticals made from food sources like dairy, carotenoids, ginger, garlic, and turmeric are considerably healthier and may give our bodies all the critical nutrients they need. They are readily available in food shops and stop the worsening of serious conditions associated to life, such diabetes and even cancer. A nutritious diet may be

the most alluring choice for neuroprotection, and having good mental health is important.Functional foods still need to be thoroughly investigated for their safety before being made available on the market for ingestion in raw forms.

- *Non-Traditional Nutraceuticals*

These include foods obtained from the breeding of agricultural products and nutrients, such as orange juice fortified with calcium, vitamins and minerals in cereals, etc. Cultural scientists have successfully invented techniques and have changed the nutritional content of crops, and more research is being carried out to improve the quality of nutrition in crops.

- *Fortified Nutraceuticals*

These are the kinds of nutraceuticals that are created through breeding in the agricultural sector, strengthening nutrients like minerals in cereals, calcium, folic acid, iron, milk fortified with cholecalciferol to treat vitamin D insufficiency, etc.

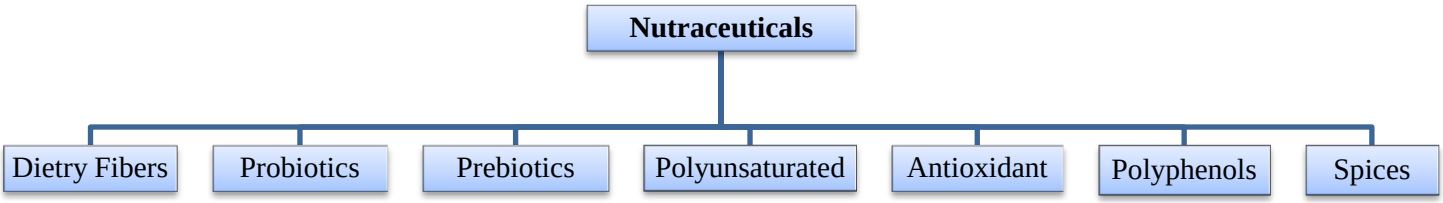
- *Recombinant Nutraceuticals*

Recombinant nutraceuticals are those obtained by the incorporation of biotechnology in food items. These nutraceuticals are among the most widely utilised types of products; they include the process of removing nutrients from foods like dairy, cheese, and bread in order to obtain an enzyme that, when used at the right dosages, has therapeutic benefits.

In order to increase the amount of nutrients in already existing food supplements and to increase the number of benefits in the same amount of food consumed, non-traditional nutraceuticals have arisen.The Food and Drug Administration (FDA) currently does not have any regulations governing the manufacture of nutraceuticals. The bioavailability of improved nutrients is often low in a variety of situations and is not checked.

Classifications:

Nutraceuticals are classified on the basis of food source and chemical nature. Nutraceuticals are classified into seven different types based on food source:



Dietary fibers

Plant origin substances present in food which are not digested and add bulk to the intestinal contents. Examples: Fruits, barley, oats, lignin, cellulose, pectin.

Probiotics

These are live microbial feed supplements which when administered in adequate dose, helps in improving the intestinal microbial balance of the host.

Examples: Lactobacilli, bifidobacilli, sacromyces cervicea.

Prebiotics

These are the dietry ingredients that benefit the host by selectively altering the composition or metabolism of gut microbial flora. Examples: Chicory roots, banana, tomato and beans.

Polyunsaturated fatty acids

These may be, Omega 3 fatty acids Examples: α-linolenic acid, eicosapentaenoic acid, docosahexaenoic acid. Omega 6 fatty acid Examples: arachidonic acid found in sunflower, soyabean and corn.

Antioxidant

These include vitamin C, vitamin E and carotenoids. These vitamins are abun-dant in many fruits and vegetables and possess singlet oxygen quenching and lipid peroxidation preventing properties.

Polyphenols

These phytochemicals are produced by plant for protection against photosynthetic stress and reactive oxygen species. Examples: Flavonoids, anthocyanins and phenolic acids.

Species

These are food adjuncts used to enhance sensory quality of foods. Most of the components of spices are terpenes and essential oils.

Class Based on chemical Structure

The activity that a substance is linked to is determined by its chemical makeup. Consuming nutraceuticals based on their chemical makeup can improve therapeutic activity while lowering the possibility of adverse effects. The outcomes, though, are not what was anticipated. Every person functions differently, and some active substances have a propensity to interact with host molecules to produce hazardous features.

Class/component	Source
1) Fatty acids	Milk and Meat
2) Omega-3 fatty acids (DHA, EPA)	Fish oils, maize, mustard and grape seed
3) Polyphenols	Fruits
-Anthocyanidine	Tea, mustard seed, grape seed
-Catechins	Citrus fruits
-Flavonone	Fruits,vegetables, soyabean
-Flavones	Cocoa, chocolate, tea, grap
-Proanthocyanidine	
4) Saponins	Soya bean, chick pea
5) Phytoestrogen	Soya bean, flax, lentil seed, maize
-Diadzein, Zenistein	Flax, rye, vegetables
-Lignans	
6) Carotenoids	Carrot, maize, oats
-ß-caroteine	Fruits, vegetables
-Luteine	Eggs, citrus fruits, corn
-Zeoxanthine	Tomatoes
-Lycopene	
7) Isothiocyanate	Broccoli

Methodology

A thorough literature study on the use of nutraceuticals for neurological illnesses was conducted before the review article was started. For a thorough understanding of the subject and to assess the currently used psychoactive and neuroprotective nutraceuticals, research and review articles from various search engines and scientific databases, including Pubmed, Medline, Science Direct, Google, Scopus, Cochrane library, etc., were assessed and carefully read. After conducting a literature review, the article writing process began. The review piece took almost two months to complete in its entirety.

Types of Neurodegenerative Diseases

There are four types of neurodegenerative diseases which are shown:

Neurodegenerative diseases

1. *Amyotrophic lateral sclerosis*

2. *Parkinson's disease*
3. *Alzheimer's disease*
4. *Huntington's disease*

- **Amyotrophic lateral sclerosis (ALS)**
  Motor neurons in the cerebral cortex and the anterior horns of the spinal cord are both affected by ALS. It is a particular illness that kills the neurons in charge of voluntary muscles. It is characterised by twitching and tight muscles. It starts with a loss of strength in the arms or legs, as well as difficulties speaking or swallowing1. One important mechanism of neuronal death in ALS2 is likely to be excitotoxicity, which is mediated by glutamate and increased calcium ions.

- **Parkinson's disease (PD)**
  It is characterized by,
  - Loss of dopaminergic neurons in the basal ganglia, which create dopamine.
  - A dopamine and acetylcholine imbalance in the brain.
  - The development of lewy bodies.
  - A lack of dopamine causes stiffness, bradykinesia, and akinesia.
  - Tremor and sialorrhea are the results of an excessive quantity of acetyl choline.

- **Alzheimer's disease (AD)**
  The most prevalent type of dementia, AD is a neurological brain illness that is a collection of disorders that affects mental function4. It progresses and cannot be stopped. The first signs are memory loss and changes in personality or behaviour, together with the steady deterioration of other intellectual and thinking skills, often known as cognitive functions.
  It is characterized by,
  - Deposition of amyloid plaques and neurofibrillary tangles.
  - Decrease in acetylcholine levels in the cerebral cortex and hippocampus; and gradual and substantial loss of cognitive and behavioural function.
  - The stimulation of microglia and astrocytes, which ultimately results in neuronal malfunction and death.

- **Huntington's disease (HD)**
  The hereditary condition HD causes the death of brain cells. Uncoordinated and jerky body movements become increasingly noticeable as the illness worsens. Physical skills steadily decline until coordinated movement is no longer possible.Dementia typically results in a loss in mental capacities and the inability to speak for the patient. An autosomal dominant mutation in the huntingtin gene is what causes the condition.

Nutraceuticals in Parkinson`s diseases:

Parkinson's disease (PD) is a neurological condition that causes severely reduced levels of dopamine (DA) due to damaged dopaminergic neurons in the substantia nigra par compacta region of the brain. oxidative stress, antioxidant depletion, mitochondrial damage, and other factors all have a role in the neurodegeneration that leads to Parkinson's disease (PD). Anti-Parkinson's diseases offer symptomatic relief by boosting dopamine levels, avoiding the onset of gait and motor abnormality symptoms, and offering neuroprotection. As a result, a wide variety of pharmacological molecules are used, acting by turning on various pathways of the common pharmacotherapy. There is a need for greater study and solid evidence on the effects of vitamins on PD because numerous investigations on vitamins and their supplementation in animals and clinical studies showed inconsistent results in controlling the symptoms of PD.

Parkinson's disease can be treated with a variety of vitamins, including vitamin B3, vitamin B9 or folate, vitamin B12, vitamin B6, vitamin D, vitamin E, and vitamin C. The anti-Parkinson medications currently in

use only treat symptoms, not the illness itself. Finding the optimum lead chemical, which not only targets numerous pathways and treats disease but is also least hazardous to people, is the key difficulty. With this as the guiding principle, numerous herbal and natural remedies have undergone clinical research for use in PD. to assess and clarify if such herbal compounds can be used as an adjuvant or independent therapy in the management of disease. Due to the high degrees of variance and instability of results based on patients' comments and contributory lifestyle patterns, it is challenging to retrospectively investigate the influence of a herbal medication, food item, or supplement in a broad population. As a result, the difficulties encountered during clinical studies for synthetic herbal items limit the release of the discovered lead molecule onto the market. Natural remedies help people with Parkinson's disease (PD) by reducing the various pathologic pathways that cause it, including oxidative stress, mitochondrial failure, neuroinflammation, and apoptosis.

Targeting Mitochondrial Dysfunction and Oxidative Stress

Unchecked oxidative stress, free radicals, and mitochondrial dysfunction cause poor cellular metabolism and energy homeostasis, which affects brain function and results in neurodegenerative illnesses like Parkinson's disease (PD). However, it is unclear whether neurodegeneration results from or is caused by mitochondrial malfunction. The process causing mitochondrial malfunction has been theorised to involve mutations in mitochondrial DNA in dopaminergic neurons and damaged chains in the respiratory system in people with PD. Cells are protected by fission and fusion by the mitochondria, which control the flow of ATP and calcium to release neurotransmitters into the synaptic cleft and depolarize neurons. The maintenance of mitochondria's morphology and increased ATP synthase efficiency were shown to be functions of -Syn. Aggregates of -Syn impair the bioenergetic mitochondria's ability to produce energy and upregulate the production of reactive oxygen species, which leads to an imbalance between the oxidative state and primary neuron death in rats.

Dopaminergic neurons contain the essential pigment neuromelanin (Nm), which is extremely resistant to oxidative stress. Iron and zinc are only two of the ions that Nm can chelate with ease to keep the redox system in check. The pathogenesis of PD is significantly influenced by excess iron concentrations because high levels of Nm and iron can exacerbate neurotoxic events, which in turn cause DA to be autooxidized and cause neuroinflammation. Food ingredients other than nutraceuticals have been effectively demonstrated to stop or postpone the progression of disease by maintaining mitochondrial activity, thus solidifying its position as a significant pathogenic mechanism in Parkinson's disease (PD) . Numerous foods, phytochemicals, or artificial substances can operate to stop mitochondrial malfunction, which can stop the course of disease.

Coenzyme Q10 (CoQ10) and fish oil are effective nutritional supplements for managing Parkinson's disease (PD) because they are essential parts of the electron transport chain, actively contribute to ATP synthesis, protect against MPTP-mediated neurotoxicity, and prevent the transfer of electrons between complex 1 and other complexes. Additionally, polyphenols have multiple properties that can be used to combat the pathology of PD since they can easily cross the blood-brain barrier and have positive effects on patients' motor and gait problems by preserving dopaminergic neurons and reducing free radicals. As initially studied, lycopene is a lipid-soluble acyclic carotenoid found in red fruits and vegetables, primarily tomatoes. It has been shown to have neuroprotective effects on mice that have been exposed to 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) as well as to increase levels of dopamine (DA) in the striatum. The antioxidant activity of lycopene, along with neurobehavioral deficits, an increase in the activity of superoxide dismutase (SOD) and nicotinamide adenine dinucleotide (reduced form) (NADH) dehydrogenase at the striatal level, along with increased glutathione and decreased malonaldehyde concentrations, is what gives the substance its therapeutic effects.

Vincamine also targets iron and oxidative stress in an effort to boost DA synthesis and reduce neuronal damage. Thus, by lowering the creation of ROS and iron-chelating molecules, vincamine and vinpocetine play a key role in the management of Parkinson's disease (PD). Mito Q, another artificial substance, is also

utilised in the treatment of PD. The primary component responsible for the antioxidant action of mito Q and the maintenance of the respiratory chain is a lipophilic cation known as triphenylphosphine. The PD-protective potential of apocynin, a natural antioxidant, is being studied.

Protein Misfolding and Aggregation, as well as the Endoplasmic Reticulum (ER) Stress Pathway

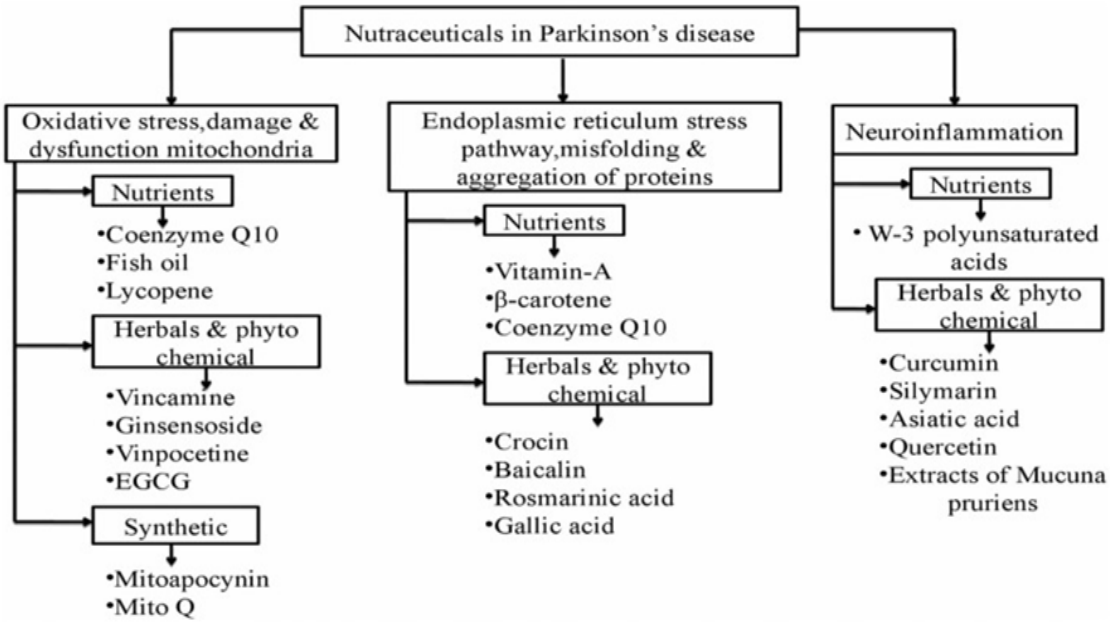
Unfolded protein responses (UPRs), which are further responsible for ER-mediated protein aggregation and destruction as well as autophagy, are triggered by abnormally misfolded proteins that produce stress in the ER. Prevention of protein aggregation and the generation of misfolded proteins is the main goal of medicines that target this mechanism. Apoptosis, or cell death, can result from the failure to clear aggregated proteins or remove damaged organelles, which can induce neurodegeneration. The most often consumed nutrition among PD patients are vitamins. However, hydrophobic antioxidants with anti-fibrillogenic activities include CoQ10, beta carotene, and vitamin A. The in vivo deposition of intracellular -Syn is immediately inhibited by vitamin A. Crocin is another phytoconstituent with neuroprotective qualities in a variety of illnesses of the central nervous system (CNS), as suggested by a series of in vivo and in vitro investigations. After exposure to MPP, this carotenoid reduces the production of CHOP and binding immunoglobulin protein (BIP)/Grp78 and blocks the activation of numerous apoptosis-related factors, such as proapoptotic factor caspase 12 PC12 cells.

Bicalein is a flavonoid that was discovered in the roots of the Iranian plant Scutellaria baicalensis georgi. This substance dramatically reduces neurotoxicity and fibrillation by delaying the synthesis of oligomers of -Syn. As a result of this flavone's propensity to prevent apoptosis, increase autophagy, and reduce inflammation and inflammatory cytokines, the levels of DA in a mouse model of MPP-induced diabetes were restored. Due of its solubility and durability, resveratrol is a strong medicinal molecule. It boosts bacteria in the gut and promotes metabolic activity, but because it has a low BBB permeability, it may reduce the bioavailability of polyphenol chemicals in the brain.

The effects of several dietary supplements on Parkinson's disease are summarized as

Parkinson's disease nutritional supplements work in three different ways. 2. By preventing the activation of misfolded proteins and their aggregation, which causes stress in the endoplasmic reticulum (ER) and ultimately leads to autophagy and the degradation of neuronal proteins. 1. By preventing oxidative stress, which protects mitochondria from further damage and dysfunction and ultimately maintains energy homeostasis and cellular metabolism. 3. Neurodegeneration and the start of Parkinson's disease are mostly caused by inflammation in neuronal cells.

Nutraceuticals in Alzheimer`s Disease (AD)



The most prevalent type of memory loss is Alzheimer's disease (AD), also known as senile dementia of the Alzheimer type (SDAT) or primary degenerative dementia of the Alzheimer's type (PDDAT) (Linseman, 2009). Super important antioxidants are one class of well-known nutraceuticals that can be used to treat all chronic diseases caused by oxidative stress, which plays a significant role in neurological disorders like AD. Oxidative stress is accelerated by ageing and a lack of dietary antioxidants, promoting disease progression and stimulation. Increased dietary antioxidant consumption has been linked to lower risk in AD patients, according to a number of studies, which is crucial because preventing disease is far more pleasant than treating it. Researchers also contend that preventing AD is not as difficult as previously thought. Consuming meals high in polyunsaturated, saturated, and trans fatty acids appears to slow the progression of neurodegeneration, whereas those high in trans fat can hasten it. Antioxidants are a promising therapy option for diseases because they can limit their development and spread.

The following is a description of some of the chemicals that are helpful for AD:

Flavonoids

Catechin, epicatechin, epigallocatechin, and epigallocatechin gallate are the major flavonoids used in neurodegenerative illnesses, including Alzheimer's. These are a collection of frequently occurring polyphenolic substances that are primarily derived from the human diet. Flavonoids are mostly found in fruits, vegetables, and alcoholic beverages including wine, tea, and chocolate. Flavonoids and their metabolic byproducts have been shown to interact with the neuronal-glial signalling system, which is primarily responsible for the survival and function of neurons, and to have neurological-modulating effects. Upregulated activity of antioxidant proteins and enzymes, which results in synaptic plasticity and restoration of neuronal functions by obstructing the process of neuropathology in the brain mostly linked with AD, also affects cerebral blood flow.

Carotenoids

40 of the carotenoid family's around 700 varied members have been found to date in human tissues and blood. Lutein, zeaxanthin, lycopene, and -cryptoxanthin, including and carotenes, are the main carotenoids found in humans. Carotenoids' chemical structure can be used to determine whether or not they have antioxidant action. They may be derived mostly from orange, deep yellow, and red fruits and vegetables since they are fat-soluble pigments. In vivo and in vitro animal models have been used to conduct extensive research on the anti-inflammatory and antioxidant potential of the carotenoid astaxanthin, which is derived from seafood. Its protective effects on the microcirculatory and mitochondria have been identified, indicating that astaxanthin is a potent neuroprotective substance. Compared to individuals with mild AD, those with severe or moderate AD lack key carotenoids including lutein and beta carotene.

Crocin

The primary phytochemical found in saffron (Crocus sativus) is called crocin. For its antispasmodic, neurine sedative, gingival sedative, expectorant, stimulant, and carminative effects, it has been utilised for ages. It has been demonstrated that saffron helps to avoid inflammatory illnesses, epilepsy, and depression. Because ethanol blocks crocin's long-term potential, which makes it known to improve learning and memory, it is used to treat neurodegenerative diseases like AD. In patients with mild to severe AD, crocin seems to enhance cognition via ADAS-Cog and CDR-SD-mediated enzymes. Through numerous investigations, it has been determined that crocin can drastically change the levels of oxidative markers in the hippocampus region and eliminate the negative effects of chronic stress on memory and learning.

Cyanidin

Cyanidin (anthocyanidins), which is mostly found in cranberries, strawberries, etc., is one of the other important substances. It has significant anti-inflammatory and neuroprotective effects by preventing the activation of proinflammatory cytokines, which leads to the damage of brain cells. Phospholipase A2, which

plays a major role in the signalling of proinflammatory cytokines and oxidative stress parameters and whose inhibition exhibits extraordinary neuroprotection, can be said to play the key function in this process.

Luteolin

Flavones like luteolin and apigenin have exceptional neuroprotective properties. These flavone-rich chemicals primarily come from celery, parsley, and rosemary. The amazing pharmacological effects of these phytoconstituents include their capacity to shield DNA from hydrogen peroxide-mediated toxicity, which further reduces inflammation and cell damage in Alzheimer's.

Conclusion

Nutraceuticals, which offer health advantages and serve as an alternative to contemporary medicine, have attracted increasing attention in recent years. It might be feasible to lessen or do away with the requirement for traditional pharmaceuticals and lessen the likelihood of any negative side effects by using nutraceuticals. dietary supplements shown to have physiological advantages and to offer defence against neurodegenerative illnesses. Nature has given us excellent herbal substances that have a great deal of promise for the treatment and avoidance of serious illnesses and disorders linked to unhealthy lifestyles, such as neurodegeneration. Numerous studies have clearly highlighted the part phytonutrients play in combating neurodegeneration and preventing cognitive. The neuroprotective, anti-inflammatory, antioxidant, hypolipidemic, and healing qualities of nutraceuticals are responsible for their therapeutic effects. These features work by targeting various ligands and receptors to increase protein synthesis, which in turn results in neuroprotection. A healthy neurological system can result from inhibiting the folding and breakdown of proteins. In this time of numerous crises in the public health system, experimental research on plant products has offered new directions for the accessible treatment of neurodegenerative illnesses.

Similar to many other neurodegenerative illnesses, PD is a crippling condition that gradually robs a person of their basic bodily functions. Even though there has been a lot of work done to advance therapy techniques for this disease, many conventional and current treatment approaches unfortunately come with a number of side effects despite being able to alleviate symptoms. Fortunately, the development of nutraceuticals has opened up a different approach to dealing with this biological issue that appears to be evasive. Nutraceuticals appear to be a good treatment choice because they are made from naturally occurring foods or food products. By using therapeutic procedures derived from natural resources, adverse effects may be avoided. As a final thought, it is encouraging to think that one day we will be able to stop or slow the growth of this crippling disease by just changing our diet.

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