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Role of Nutraceuticals in Human Health and Disease Prevention

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Abstract

Nutraceuticals are meals that include every vital ingredient needed to sustain optimum health. They are employed as substitutes for contemporary medications to improve health, boost diet nutrient content, and lengthen life span. Because of their anticipated safety and therapeutic benefits, they have garnered a lot of enthusiasm. In general, people who want to improve their health prefer food supplements over medications because of the potential for negative reactions and unwanted reactions. It has been discovered that. nutraceuticals contribute to immune system and cardiovascular health, and they also help prevent cancer and infections.

Keywords – Nutrients, Dietary Supplements, Nutraceuticals, Diseases, medicines, immune enhancement, Anti-inflammatory, Health promotion, essential nutrients, food supplements, therapeutic effects

INTRODUCTION

The wise words of Hippocrates, who was alive approximately 2,000 years, “Let food be your medicine, and medicine be your food.” There has been a boom of curiosity worldwide in “nutraceuticals” due to the realization that they are essential for improving health. the public Interest in these goods presents an opportunity for the nutraceutical and functional food businesses to capitalize. All businesses, whether they are modest vitamin sellers, giant food multinationals, pharmaceutical corporations, or nutritional companies, are aware of the shifting consumer trends and the increasing health-consciousness trend. This has led to the overabundance of value-added products that are intended to prevent and treat a wide range of illnesses, from cancer to heart disease, in addition to helping people maintain their health.[1] Nutraceuticals is a concept that was Created by Stephen De Felice in 1989, and it’s combination of the item pharmaceutical an nutrition. “A food (or part of a food that provides medical or health benefits, including the prevention and/or treatment of a disease,” is how he described a nutritional supplement.[2]

To comply with strict regulatory standards, the term “dietary supplements” is typically used instead of the less common word. However, a microscopic cross-section of the two phrases exposes some fundamental distinctions, such as the fact that nutraceuticals should d never be used as a diet supplement—rather, they should always be accustomed to help avoid or cure illness.

Nutraceuticals are employed in a variety of clinical problems, include arthritis, allergies, immunodeficiency, and inflammation, cancer, dyspepsia, depression, insomnia, high blood pressure, and blood cholesterol regulation, in addition to lifestyle issues. A healthy aging can be mostly determined by lifestyle factors such as nutrition, smoking, and sedentary behaviours, even though there may be a substantial genetic element at the outset among these diseases’ prevention strategies, including Age-related diseases can be delayed by eating a Mediterranean diet or exercising frequently Illnesses [3].

What are Nutraceutical

The founder and head of the Foundation for Innovation in Medicine, Stephen DeFelice, came up with the term in 1989. word "nutraceuticals." "Food, or parts of a food, that provide medical or health benefits, including the prevention and treatment of disease" is the definition of a nutraceutical. Natural ingredient-based pharmaceutical products are included in the definition. The classes of nutraceuticals with the best evidence are briefly reviewed here. A number of these classes have been proposed as being helpful in treating various diseases.[4]

Classification of Nutraceuticals based on chemical composition

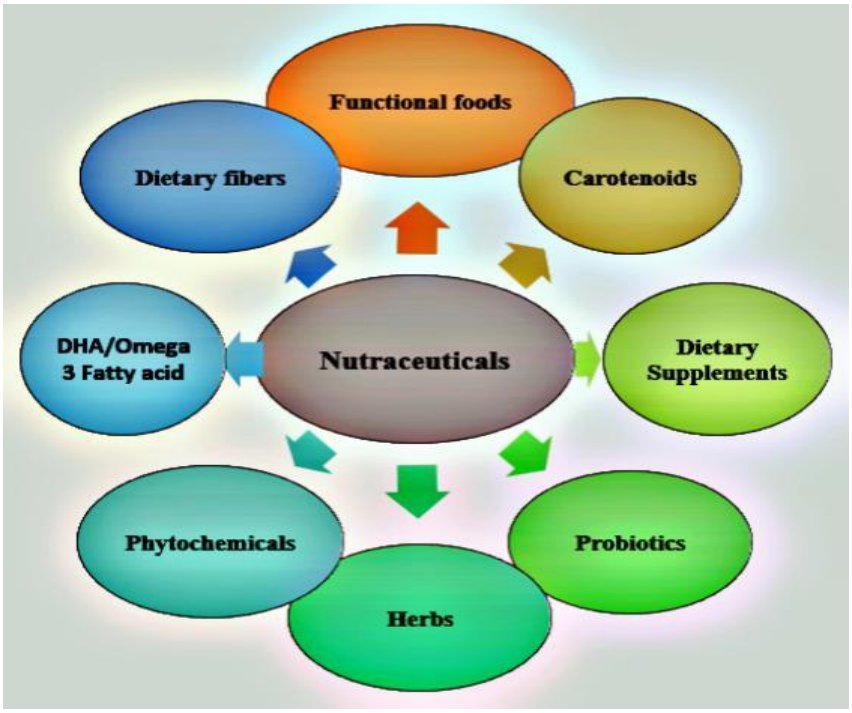

***Figure 1*:** *Nutraceuticals*

Organizing Nutraceuticals

Nutraceuticals are divided into the following categories according to their food sources:

Nutrition Fibers

Dietary fibers that substances that are obtained from plants and found in meals or contributes volume To the contents of the gastrointestinal system without being Reabsorbed by the gastrointestinal tract. Consuming fiber-rich foods is associated with a decreased chance of Colon Cancer, Obesity, Hypertension, Cardiovascular illness, Gastrointestinal Disorders. Dietary fibers include things like Fruits, Barley, Oats, Cellulose, Pectin, And Lignin Etc. A diverse range of materials known as dietary fiber are resistant to being broken down in the small intestine by digesting enzymes found in humans. The most significant fibers found in plant foods include Pectin, inulin, cellulose, hemicellulose, glucan, and starch that resists digestion, among others.

Furthermore, a few low-fiber supplement studies that were randomized, placebo-controlled, and undertaken in the senior population have confirmed the positive benefits on a number of CVD-risk variables, including blood pressure, triglycerides, MS, LDL, and triglycerides.[5] Nevertheless, no research has been done on the effects of dietary fiber supplements at larger doses than what can be obtained through diet in the older population with regard to CVD-risk factors.

Probiotics

Probiotics are food supplements containing living microbes that, when consumed in adequate quantities, aid in restoring the host's gut microbial equilibrium.

They lessen the chance of developing allergies, asthma, cancer, and urinary tract and ear infections. Probiotics include, for example, Lactobacilli etc. When taken in adequate amounts, probiotics—live bacteria—benefit the host's health.[6] Gram-positive bacteria that produce lactic acid belong to the genera Lactobacillus and Bifidobacterium found In various foods And make up A significant portion of the natural the bacteria in the gut, are home to Most probiotic micro-organisms, utilized Regarding Nutraceutical. Probiotics also contain certain Saccharomyces cerevisiae and boulardii are two examples of yeast, which are present bread, wine, beer, mangosteen fruit, and so forth [7].

Prebiotics

Prebiotics are naturally occurring or artificially supplied fructose-based oligosaccharides that are indigestible to humans. It has been discovered that they help with constipation, detoxification, dyslipidemia, lactose intolerance, and some types of tumors. Beans, tomatoes, bananas, and chicory roots are a few examples. Prebiotics are found in food substances which help the host by specifically modifying the gut's makeup or metabolism bacteria. They are naturally occurring or artificially supplied fructose-based oligosaccharides that are indigestible to humans. It has been discovered that they help with constipation, detoxification, dyslipidemia, lactose intolerance, and some types of tumors. Beans, tomatoes, bananas, and chicory roots are a few examples.[8]

Polyunsaturated Fatty Acids

Among the omega-3 fatty acids are docosahexaenoic Acid, eicosapentaenoic acid, And alpha linoleic acid, that are present In fatty Fish, flaxseeds, soybeans, etc., are examples of polyunsaturated fatty acids. Numerous extensive randomized trials have been conducted on senior citizens to evaluate the effectiveness of omega-3 supplementation as a preventative or therapeutic measure for cardiovascular disease (CVD). Given that a significant portion of the participants in the JELIS and GISSI-Preventions trials were over 60, comprised 11, 323 individuals in primary prevention and 18, 645 patients individuals living through a recent myocardial infarction (secondary prevention).

Antioxidant Vitamins

Numerous Vegetables and fruits are high in antioxidant vitamins, which also have The capacity to stop lipids peroxidation and singlet oxygen quenching. They also help to prevent a host of ailments. Carotenoids, Vitamin C, and Vitamin E are a few examples. The antioxidants are endogenous or exogenous substance of all the nutraceuticals suggested to older adults, Single or combined vitamin supplements (multivitamins) are the most commonly used. Conversely, research has indicated that Some B-group vitamins including folic acid may possibly have a minor protective impact against age-related macular degeneration and cognitive decline, while contradictory findings have been noted in the prevention of cancer and secondary CVD prevention. Lastly, numerous studies have documented the advantageous effects OF vitamin-D administration, either on osteoporosis by itself or in combination with calcium. [9,10]

Polyphenols

Plants create phytochemicals called Anthocyanin, flavonoid, and other polyphenol phenolic acid, to protect themselves from reactive oxygen species and photosynthetic stress. They can be present in foods like tea and legumes and have anti-inflammatory and antioxidant characteristics. Cancers of the prostate and colon [CRC] prevention is still a hot topic of research.[11]

BMC Cancer 2011; 11:360. Apart from the research conducted on the protection against cardiovascular disease and cancer The use of polyphenol nutraceuticals in older adults has also assessed in a number of studies as a potential adjuvant or substitute for anti-diabetic medications. Regrettably, studies using polyphenols alone or extracts rich in polyphenols as a daily supplement have produced inconsistent outcomes when it comes to older adults. For instance, daily supplementation with grape [12].

Spices

Spices are exotic culinary additions that improve a food's sensory appeal. Their effects include immunomodulatory, anti-inflammatory, anti-mutagenic, antioxidant, and chemo preventive. Most essential oils are composed of terpenes and other constituents' ingredients in spices. Black pepper, ginger, and turmeric are a few examples.[13]

Dietary fibers

Dietary fibers are sugars derived from plants that your body is unable to properly digest. They help with many physiological functions and make it through the digestive system mostly undamaged. They fall into two primary categories:

Soluble fiber

Oats

Apple

Insoluble fiber

Nuts

Seeds

Figure 2*: *Dietary Fibres

Our bodies cannot function correctly without enzymes, which are essential to life. An individual's symptoms of digestive problems, such low blood sugar, irregular blood sugar and Obesity, may be alleviated by adding enzyme supplements made from plant, animal, and microbiological sources to their diet.[14]

Our bodies could not operate properly without enzymes, which are vital components of life. Enzyme supplements derived from microbial, plant, and animal sources may help anyone experiencing digestive problems such as hypoglycemia, irregular blood sugar levels, or obesity.

Non-traditional nutraceuticals

These products, which include orange juice enhanced with calcium, cereals supplemented with vitamins and minerals, and flour enriched with folic acid, are derived from agricultural breeding by adding nutrients and/or additives. Experts in agriculture have effectively devised methods to boost.

Foods that provide energy, such as vinegar, cheese, yogurt, bread, wine, fermented carbohydrates, and other are made possible with the use of biotechnology. Probiotics can be produced via biotechnology, together with genetic engineering by using enzyme/fermentation techniques to extract bioactive components.[15]

Nutraceuticals with added micronutrients (trace elements or vitamins)

Nutraceuticals with added micronutrients are created by first fortifying dietary components. Fortification is the procedure for enhancing food effectiveness and value of nutritional by adding essential minor components and nutrients.

Examples of specific enzymes

Lipase

The gut's lipase enzyme. Group aids in the breakdown of lipids

Amylase

Amylase aids in the conversion of carbohydrates into sugars in saliva

Maltase

This also occur in the saliva and splits the sugar maltose into glucose

Trypsin

These enzymes break proteins into amino acids in the small intestine

Helicase

DNA is unravelled by helicase enzymes

DNA polymerase

These enzymes use deoxyribonucleotide to create DNA

Classification of Nutraceutical based on their food sources

Non-Traditional Nutraceutical

Recombinant Nutraceutical

Fortified Nutraceutical

Non-Traditional Nutraceuticals

These are fake foods made possible by biotechnology. This category of foods consists of items whose nutritional content has been increased through the addition of particular nutrients or dietary components. Two further categories of nutraceuticals are recombinant and fortified.[16]

Recombinant Nutraceuticals

Probiotics and other bioactive ingredients are included in these products, which are produced via fermentation, enzyme technologies, genetic engineering, and other techniques. Additionally, meals that supply energy, like beer, cheese, yogurt, fermented grains, vinegar, bread, and more, are made using innovative biotechnology.[17]

Fortified Nutraceuticals

The process of adding certain micronutrients, such vitamins and trace minerals, to food in order to improve its nutritional value and efficacy is known as fortification. Through the production of SCFAs, probiotics can help the microbiota return to its typical state of abundance and diversity. There have been claims that nutraceuticals offer protection against the following diseases or physiological benefits and/or have been found to act as.[18]

Agent for the heart

Agents of antibiotics

Insulin-producing agent

Agents anticancer Booster for the immune system

Inflammation of chronic

Nutraceuticals Applied to Different Diseases

Sr. No.	Disease	Examples
1.	Alzheimer	Vitamin E and Vitamin C
2.	Cardiovascular	Flavonoids (Onion, Black Grapes)
3.	Parkinson	Vitamin E
4.	Obesity	Chitosan, Vitamin C
5.	Diabetes	Calcium, Vitamin D, Emblica Officinalis
6.	Osteoarithritis	Glucosamine, Chondroitin Sulphate

Table 1*: *Many Nutraceuticals Applied to Different Disease

Purpose of Nutraceuticals in Distinctive Disease Prevention

Diabetes

High consumption of isoflavones (20–100 mg/days) connected to a decreased incidence among some cancer, Osteoporosis, heart diseases, and type II diabetes. omega-3-fatty acid have also been suggested as a way to improve Susceptibility to glucoses in individuals who are at risk for the condition. Patients may find ethyl esters of n-3-fatty acids beneficial if they have diabetes. Not only is essential for neurovascular development, but it also controls resistance to insulin. In particular, this is important for females who have pregnancy-related diabetes mellitus as they Are more likely to benefit from the essential fatty acid guideline throughout pregnancy. A common antioxidant, lipoid acid is currently As a treatment for diabetic neuropathy in Germany.[19]

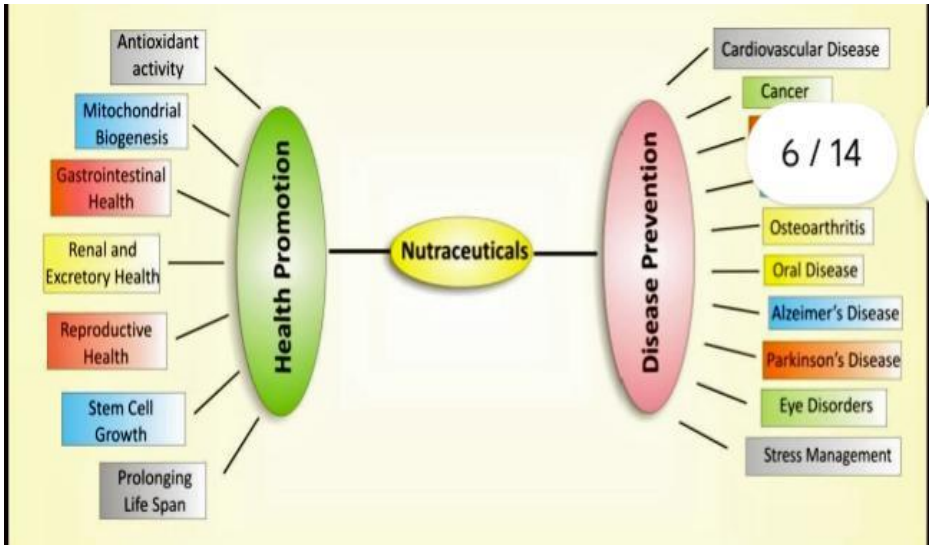

***Figure 3*:** *Nutraceuticals In Health Promotion and Disease Prevention*

Magnesium increases insulin sensitivity and lowers the risk of diabetes. In certain diabetics, Additionally, Calcium and vitamin-D increase improve glycemic control and insulin sensitivity management. Ginger aids digestion and can help manage digestive discomfort. The powerful combination of turmeric, pomegranate, and ginger eases the symptoms of a cold or cough.[20]

Blood Sugar Level

Stage	Fasting	After Eating	2-3 Hours After Eating
Normal	80 - 100	170 - 200	120 - 140
Pre-Diabetic	101 - 225	190 - 230	140 - 160
Diabetic	126+	220 - 230	200+

***Table 2*:** *Blood Sugar Level*

Cancer

Flavonoids diminish the incidence of malignancies caused by estrogen by blocking the enzymes that create estrogen. It is advised to take phytoestrogens to prevent breast and prostate cancer. Soy foods are rich in isoflavones; curcumin from curries and isoflavones from soy have the ability to prevent cancer through chemotherapy. Concentrations of lycopene in the skin, testicles, adrenal glands, and prostate can prevent cancer. Antitumor and antimutagenic properties are seen in saponins. Turmeric's polyphenol curcumin (diferuloylmethane) has anti-inflammatory, anti-carcinogenic, and antioxidative qualities. There have been reports of anti-tumor properties in spinach leaves, cucumber fruits, beet roots, and turmeric rhizomes. [21]

Nutraceuticals As a Preventative Measure against Alzheimer disease

Alzheimer's disease (AD), often referred to as primary degenerative dementia of the Alzheimer's type (PDDAT), senile dementia of the Alzheimer type (SDAT), or simply Alzheimer's, is the most common form of dementia.

The various nutraceuticals used to treat Alzheimer's disease are listed below:
Antioxidants
Alpha-lipoic acid
Phosphatidylserines
The primary clinical symptom of Memory loss and gradual dementia are hallmarks of Alzheimer's disease (AD). Due in part to the higher number of women over 70, women are afflicted ‘at a ratio of nearly 2:1 more than males.

Use of Nutraceutical for treatment of AD:

Golden root
Ginseng
Lemon balm
Ursolic acid
Blueberry
Curcumin
Calabar bean
Moss
Rosemary

Parkinson disease

Parkinson diseases are a neurological condition they often strike in middle- to late-life and is caused due to nerve loss in a specific area of the brain that result in muscle rigidity, shaking, and difficulty walking.[22]

A decrease in the clinical symptoms of Parkinson’s disease suggested that creatine altered its characteristics.[23] Individuals must be made aware that over-the-counters pharmaceuticals can are costly, have adverse effects, and interact with other prescription drugs. Consuming a much of vitamin-E may help prevent Parkinson Disease.[24] The effects of glutathione on nerves and its efficacy as an antioxidant have also been studied. Unknowns include the longrange dosage, adverse effect, and the best administration methodology.

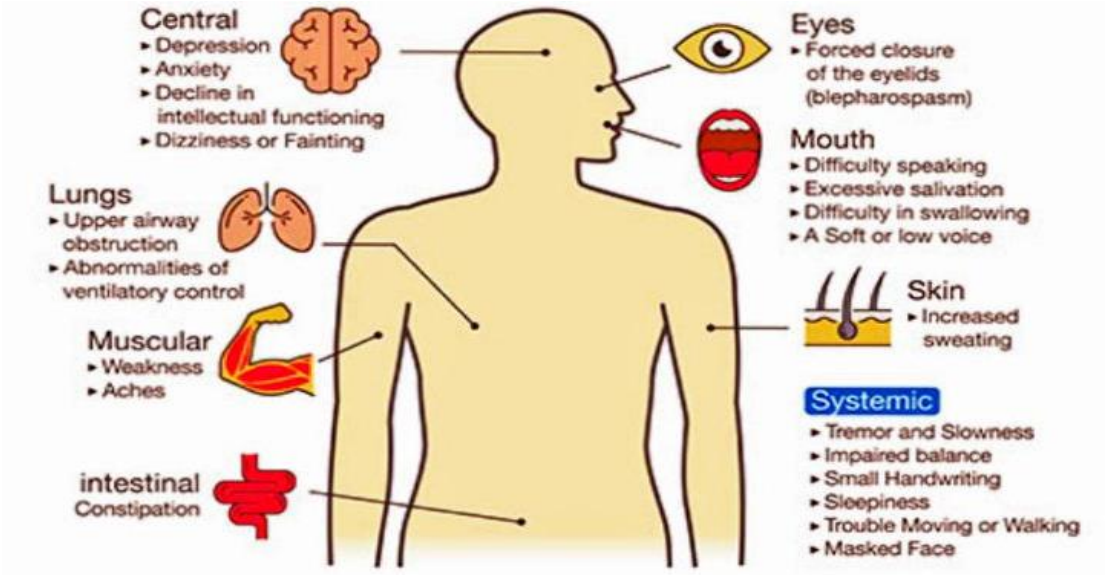

Figure 4: *Sign and Symptoms of Parkinson Disease*

Cardiovascular Disease

Garlic is helpful in the treat of heart illness. Allicin, a substance that is produced in large quantities as soon as garlic chopped, Macerated, and Crushed, is thought as the cause of garlic's biological activities according to recent research.

Thus, the primary chemical thought to be responsible for the health benefit of consuming garlic is allicin.[25] Vitamin D is another crucial vitamin linked to cardiovascular illnesses.

This vitamin is mostly found in some types of fish and is produced by the skin in response to sun exposure. It is also absorbed through the food.[26] Vitamin D has a classical role in regulating calcium-phosphate homeostasis and also appears to exert immunoregulatory and anti-inflammatory effects. [27 It seems that breaking down the ATR1 disulfide bridge. [28 Although raw garlic contains other sulphur compounds, their percentage is smaller than that of alliin. Until the alliinase enzyme and alliin molecule react, garlic has no smell. Following the release of alliin and alliinase, the catalysis for the production of allicin occurs, as this component of intact Garlic substance Are kept in separate Vesicles and vacuole until.

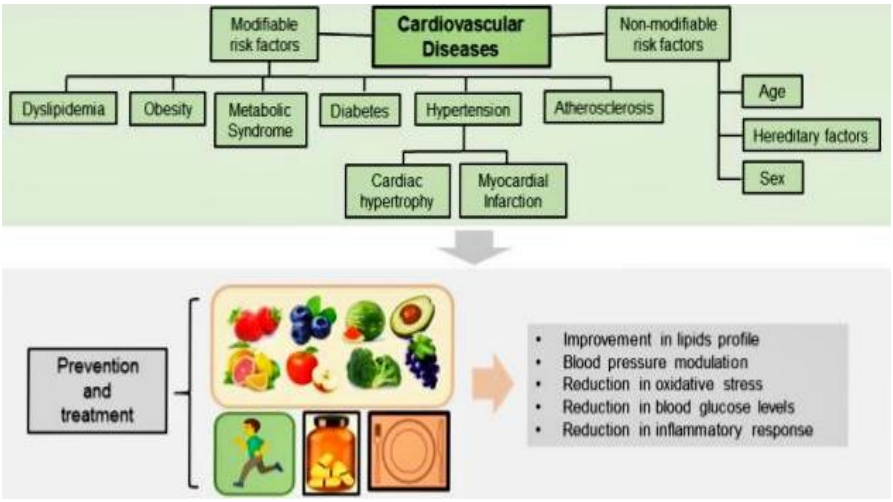

Figure 5*: *Types of Cardiovascular Disease

Treatment of Curcumin against Obesity

People who fit into one of the obesity categories defined by the WHO. one of the main causes of this sharp increase increasing accessibility to high-fat foods is a contributing factor to obesity prevalence, high-energy meals.[29] The buildup of excess body fat that causes obesity is a chronic illness that raises the danger of metabolic disorders and other disease. Obesity is defined by BMI is recognized by the World Health Organization, of more than 35 mi0 kg/m2 or a measurement of the waist of at least 102 cm for men and 88 cm for women. In East Asia, the threshold (25 kg/m2) for BMI to be considered obesity.[30] While BMI is a helpful measure of body fat, determining the distribution of body fat is a better way to forecast Risk factors for cardiovascular diseases and metabolic syndrome.[31]

Figure 6*: *Causes of Obesity

Numerous inflammatory conditions, including as obesity and other metabolic disorders, are treated with it. The primary Turmeric Curcuminoid, a popular Indian Spice that is a member of the Zingiberaceae family, is curcumin. The mammalian symptom employs hydroxyl citric acid as a potent biochemical control of obesity lipid disorders, as was recently revealed. India's traditional medicine is known as ayurveda.[32]

Other Nutraceuticals against treatment of obesity

Psyllium
Nigella Sativa
Spirulina
Chitosan

Nutraceutical extract compositions are most commonly employed; examples include rhizome of zingiber officinale with radix of Angelicae sinensis. Numerous reports have Also indicated that Z,. officinale activates the AMPK signalling pathway. [33,34]

Chronic disease

There are three primary categories of tea: green, oolong, and black tea. According to reports, green tea can help prevent cancer, heart disease, and neurological diseases, among other chronic illnesses. Chinese tradition suggests that green tea can help regulate weight by eliminating fat. This suggests that green tea has weight-loss effects. Three primary ingredients found in green tea leaves influence people's Health, they are: [35]

Xanthine bases (Caffeine and thiophylline)
Essential oil
Polyphenolic compound

Stress Management

Stress is an essential component of our mental health and a danger to our survival. The naturally occurring bioactive substances known as adaptogens aid in preventing cellular damage brought on by stress. They produce a non-specific boost in an organism's resilience to harmful impacts and work to restore equilibrium and normalcy for mental and stress health. heat Shock Protein 70, which suppresses stress, is produced, it is activated by herbal nutraceuticals such as Ashwagandha also stabilize physiological procedures, support equilibrium, strengthen resilience to external stress, lessen moderate to severe anxiety, enhance secondary memory, improve sleep, and lessen sadness.[36]

COVID-19

It has been demonstrated that nutraceuticals such as omega-3 fatty acids, zinc, vitamins C, D, and E can strengthen the immune system, which is essential for battling viral infections. It is well established that COVID-19 triggers a cytokine storm, a hyper-inflammatory reaction that can cause serious lung problems and damage. Curcumin, resveratrol, and quercetin are examples of nutraceuticals with antioxidant and anti-inflammatory qualities that can aid in regulating the inflammatory pathways. Nutraceuticals, which are health-promoting bioactive substances included in food, have been researched for their potential to increase immunity and lessen the effects of COVID-19.

Turmeric has strong antioxidant properties and it is health beneficial and many ailments, including as scabies, snake bites, asthma, cough, dropsy. Vitamin-C vitamin C acts as an antioxidant and may help reduce the severity of viral infections. Vitamin-D can lessen the chance of experiencing severe symptoms of COVID-19.

Range and Product Types of Nutraceuticals offered in the Market

Nutraceuticals, a term coined in 1989 by Nutrition and Pharmaceutical, are food consequences on human health with a therapeutic impact on human health. It consists of medicinal foods intended for illness prevention and treatment, probiotics and prebiotics, herbal items, and dietary supplements.

Major Nutraceuticals have a lack of side effects and several therapeutic outcomes. Nutraceuticals have been shown to offer protection against chronic disease or to have physiological benefits. A Few common Omega-3 fatty acids (MUFA, PUFA), ginseng, Echinacea, glucosamine, folic acid, cod liver oil, calcium-enriched orange juice, green tea, plant phenols, and more are examples of nutraceutical. Depending on how they are best understood and used, academic numerous arrangements are possible for nutraceuticals, including clinical trial design, academic instruction, or Foods that are functional O 5O 1OO 15O 2OO 25O 3OO 35O 40O 45O development in Europe or the United State food suggestions for India Japan. The most often used classification schemes for nutraceuticals include those based on chemical makeup, mode of action, and food source.[37]

CONCLUSION

All age groups accept nutraceuticals because of their great quality, purity, safety, and effectiveness. They are essential for defending opposite to pathology of many Age-Related and Chronic illnesses. The opinion of consumers regarding the connection between diet and illness will determine the future demand for nutraceuticals. Consuming nutraceuticals can prevent disease and help people maintain general health because they have been shown to provide health advantages. All age groups accept them widely because of their superior quality, safety, efficacy, and ability to cure and promote health ailments. In the contemporary self-medication environment, nutraceuticals are important for the advancement of health. Nutraceuticals are becoming more widely acknowledged for that's potential benefits in the prevention of osteoporosis, cancer, obesity, diabetes, heart illness, as well as further degenerative and Chronic conditions, like Parkinson and Alzheimer. The list of nutraceuticals under investigation is always evolving to reflect new requests, customer interest, and continuing research.

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