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Chronic Disease Management with Nutraceuticals

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ABSTRACT: *For normal functioning of the body a number of natural products such as vitamins, nutrients from the plants play a great role in our daily life. They are helpful in maintaining the health of the individual and in reducing the risk of various chronic diseases. Nutraceuticals are medicinal foods for well being, enhancing health, modulating immunity as a result it can prevents diseases. In the present review a number of neutraceuticals or photochemicals such as omega-3-fatty acids, dietary fibers, vitamins, antioxidants, plant sterols, flavonoids from the medicinal plants that have beneficial effects on the chronic diseases. Nutraceuticals without any side effects, less cost and also abundant helps to prevent a number of chronic diseases and act as chronic fighters.*

Keywords*: Nutraceuticals, medicinal plants, functional foods, chronic disorders.*

I. INTRODUCTION

Nutraceutical is a food or food product that provides health and medical benefits, including the prevention and treatment of disease. A nutraceutical have a physiological benefit or provide protection against chronic disease[1]. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered foods, herbal products, and processed foods such as cereals, soups, and beverages. It is a food stuff that provides health benefits[2]. The use of nutraceuticals, with reduced side effects, as compared with other therapeutic agents, analysis of food was limited to the flavor of food and its nutritional value (composition of carbohydrates, fats, proteins, water, vitamins and minerals). These chemical components are derived from plant, food, and microbial sources, and provide medicinal benefits valuable to long-term health. Some of these nutraceutical chemicals include probiotics, antioxidants, and phytochemicals. Products prevent chronic diseases, improve health, delay the aging process, and increase life expectancy[3]. There are multiple different types of products that may fall under the category of nutraceuticals. Dietary supplements, Functional foods, Medical foods and Pharmaceuticals.

Medicinal plants containing phytochemicals, secondary metabolites or primary metabolites that have a medicinal action in humans and animals. Nutraceutical plants produce healthy phytochemical those are formulated and intake is in the form of capsules, tinctures or tablets. Functional foods are a component of nutraceuticals and are consumed as foods Medicinal and nutraceutical plants offers a wide range of products utilized in the pharmaceutical and functional food industries. The following are the crops for their medicinal and nutraceutical attributes.

Aloe Vera leaves: *Aloe vera* is succulent plant that originated in northern Africa. The species is frequently used in herbal medicine. Extracts from *A. vera* are widely used in the cosmetics and alternative medicine industries and variously having rejuvenating, healing or soothing properties.

Fig 1: Aloe vera gel

The cosmetic and alternative medicine industries regularly make the soothing, moisturizing, and healing properties of aloe vera[4,5]. Aloe vera gel is used as an ingredient in commercially available lotions, yogurt, beverages, and some desserts [6.7.8], although at certain doses, it has toxic properties when used either for ingested or topical applications[9]. Aloin, a compound found in the exudate of some *Aloe* species, was the common ingredient in over-the-counter (OTC) laxative , when the Food and Drug Administration ruled that aloin was a class III ingredient, thereby banning its use[10]. *Aloe vera* has potential toxicity, with side-effects occurring at some dose levels both when ingested and applied topically[11]. Although toxicity may be less when aloin is removed by processing, aloe vera that contains aloin in excess amounts may induce side-effects[12]. The extracts and quantities typically used for such purposes appear to be dose-dependent for toxic effects. *Aloe vera* leavescontain phytochemicals, acetylated mannans, polymannans, anthraquinone Cglycosides, anthrones, a nthraquinones, such asemodin, and various lectins[13]. Some of these compounds are used to Manufacture insecticides[14].

Aloe vera is now widely used on facial tissues, where it is promoted as a moisturiser and/or anti-irritant to reduce chafing of the nose of users suffering hay-fever or cold. *Aloe vera* products are useful in makeup, tissues, moisturizers, soaps, sunscreens, incense, shaving cream, and shampoos[15]. Other uses of *Aloe vera* include the dilution of semen for the artificial fertilization of sheep[16], use as fresh food preservative, and use in water conservation in small farms. It has also been suggested that biofuels could be obtained from *Aloe vera* seeds. Aloe is also used as a food substance. It has an advantage of its gelling properties.

1.1 *Aloe vera* is effective in treatment of wounds[17]. *Aloe vera* promotes the rates of healing[18], Topical application of *Aloe vera* may also be effective for genital herpes and psoriasis[19]. *Aloe vera* have antibacterial and antifungal activities, which possibly could help treat minor skin infections, such as boils and benign skin cysts and may inhibit growth of fungi causing tinea[20]. For bacteria, inner-leaf gel from *Aloe vera* was to inhibit growth of *Streptococcus* and *Shigella* species in vitro. Compounds extracted from *Aloe vera* have been used as an immune stimulant that aids in fighting cancers; in cats and dogs.

There is preliminary evidence that *Aloe vera* extracts may be useful in the treatment of diabetes and elevated blood lipids in humans. These positive effects are thought to be due to the presence of compounds such as mannans, anthraquinones and lectins. Internal intake of *Aloe vera* has improved blood glucose levels in diabetics[21], oral *Aloe vera* gel may reduce symptoms and inflammation in patients with ulcerative colitis.

Ingestion of *Aloe vera* is associated with diarrhea, electrolyte imbalance, kidney dysfunction, and conventional drug interactions; episodes of contact dermatitis, erythema, and phototoxicity have been reported from topical applications. Diarrhea, caused by the laxative effect of oral *Aloe vera*, can decrease the absorption of many drugs.

Fig 2: Aloe vera

Amaranthus: It is a cosmopolitan genus of annual or short-lived perennial plants. Catkin-like cymes of densely packed flowers grow in summer or autumn[22]. People around the world value amaranths as leaf vegetables, cereals, and ornamental plants. Squalene is a organic acid found in Amaranthus seed having antioxidant and anticancerous agent. Besides this squalene it is also having beta-sitisterol which acts as a anticancer agent. Amaranth oil which is extracted from the seeds of it is having a number of anticancerous and antioxidant properties.

Amaranthus is also helps to cure cardiac diseases and helps to remove fat from the tissues and body.

Fig 3: ***Amaranthus***

Candelilla (Euphorbia antisyphilitica): *Euphorbia antisyphilitica* is a species of spurge that is native to of Texas and southern New Mexico in the United States as well as Chihuahua, Coahuila, Hidalgo, and Querétaro in Mexico[23]. Commonly called as Candelilla and Wax Plant, It is shrubby and has densely clustered, erect, essentially leafless stems that are covered in wax to prevent transpiration[24]. The white sap of *E. antisyphilitica* was historically used in Mexico to treat sexually-transmitted diseases. The availability of cheaper petroleum-based waxes are from this plant.

Fig 4: ***Euphorbia antisyphilitica***

Echinacea angustifolia: (Narrow-leaved purple coneflower, black Samson Echinacea) is a herbaceous plant species in Asteraceae. The stems and leaves are moderately to densely hairy. Many Native American groups used this plant for a variety of medicinal purposes, Echinacea, when taken at first sign of cold, reduced cold symptoms or shortened their duration[25]. Echinacea can help to treat, prevent or cure cancer. Echinacea can help relieve side effects from cancer treatments such as chemotherapy and radiotherapy.

Fig 5: ***Echinacea angustifolia***

Oenothera biennis: *It* is a species of *Oenothera* native to eastern and central North America. *Oenothera biennis* has a life span of two years (biennial). The leaves are lanceolate, 5–20 cm long and 1–2.5 cm broad. The blooms are yellow, 2.5–5 cm diameter, with four bilobed petals. The flower structure has an invisible to the naked eye bright nectar guide pattern. This pattern is apparent under ultraviolet light and visible to its pollinators, moths, butterflies and bees. The fruit is a capsule 2–4 cm long and 4–6 mm broad, containing numerous 1–2 mm long seeds, released when the capsule splits into four sections at maturity [26], [27]. The mature seeds contain approximately 7–10% gamma-linolenic acid, an essential fatty acid. The *O. biennis* seed oil is used to reduce the pains of premenstrual stress syndrome and is beneficial to the skin of the face. Also, poultices containing *O. biennis* were at one time used to ease bruises and speed wound healing. Its leaves are edible and traditionally were used as a leaf vegetable[28].

Fig 6*: Evening primrose (Oenothera biennis)*

American ginseng (Panax quinquefolius) It is a herbaceous perennial plant in the ivy family, commonly used as Chinese or herbal medicine. It is native to eastern North America, though it is also cultivated in places such as China[29]. Like *Panax ginseng*, American ginseng contains dammarane-type ginsenosides, or saponins, as the major biologically active constituents. When taken orally, PPD-type ginsenosides are mostly metabolized by intestinal bacteria (anaerobes) to PPD monoglucoside, 20-O-beta-D-glucopyranosyl-20(S)-protopanaxadiol (M1)[30]. In humans, M1 is detected in plasma from seven hours after intake of PPD-type ginsenosides and in urine from 12 hours after intake. These findings indicate M1 is the final metabolite of PPD-type ginsenosides[31].

Fig 7: Panax quinquefolius

The Gavar bean or cluster bean **(***Cyamopsis tetragonoloba***)** is an annual legume and the source of guar gum**.** This legume is a very valuable plant as it lives in symbiosis with nitrogen-fixing bacteria[32]. Guar as a plant has a multitude of different functions for human and animal nutrition but its gelling agent containing seeds (guar gum) are today the most important use[33]. Demand is rising rapidly due to industrial use of guar gum in hydraulic fracturing (oil shale gas). About 80% of world production occurs in India and Pakistan, but, due to strong demand, the plant is being introduced into new areas. Guar leaves can be used like spinach and the pods are prepared like salad or vegetables[34]. Its beans are very nutritious but the guar protein is not usable by humans unless toasted to destroy the trypsin inhibitor. In baked goods it is used as dough improver, in cheese industries it is used as texture improver. It is used to maintain regularity. PHGG is used in foods for particulate suspension, emulsification, antistaling, ice crystal control, and reduced fat baked goods.

Fig 8: Cyamopsis tetragonoloba

It has Calories from proteins - 20.00 Calories from Fat - 0.00 Total Fat - 0.00 g Saturated Fat - 0.00 g Trans Fat - 0 g Cholesterol - 0.00 mg Sodium - 2.00 mg Total Carbohydrate - 6.00 g Dietary Fiber - 6.00 g Sugars - 0.00 g Protein - 0.00 g Vitamin A - 0.00% Vitamin C - 0.00% Calcium - 0.00% Iron - 1.00% Percent Daily Values (DV) are based on a 2000 calorie diet.

Derivatives of guar gum that has been used in industrial applications, such as the paper and textile industry, ore flotation, the manufacture of explosives and hydraulic fracturing (fracking) of oil and gas formations[35]. Guar gum is often cross linked with boron or chromium ions to make it more stable and heat-resistant. The cross linking of guar with metal ions results in a linear gel that does not block the formation and helps efficiently in formation cleaning process.

Pelargonium: It is a genus of flowering plants, perennials, succulents, and shrubs, commonly known as geraniums. *Pelargonium* species are evergreen perennials indigenous to Southern Africa, and are drought and heat tolerant, but can tolerate only minor frosts. They are extremely popular garden plants, grown as bedding plants in temperate regions. The primary uses have been for intestinal problems, wounds and respiratory ailments, but *Pelargonium* species have also been used to treat fevers, kidney complaints and other conditions. *Geranium (Pelargonium)* oil is considered a relaxant in aromatherapy, respiratory/cold remedies made from *P. sidoides and P. reniforme* have been sold in Europe and the United States[36]. *P. sidoides* along with Echinacea is used to treat bronchitis[37]. *P. odoratissimum* is used for its astringent, tonic and antiseptic effects. It is used internally for debility, gastro-enteritis, and hemorrhage and externally for skin complaints, injuries, and neuralgia and throat infections. The essential oil is used in aromatherapy. It is also used to balance the hormonal system, menstrual flow, and clean the body of toxins[38].

Fig 9*: Pelargonium*

Salvia is the largest genus of plants in the mint family, is a psychoactive plant which can induce dissociative effects and is a potent producer of "visions" and other hallucinatory experiences. Its native habitat is within cloud forest in the isolated Sierra Mazateca of Oaxaca, Mexico, where it grows in shady and moist locations[39, 40]. The plant grows to over a meter high, has hollow square stems, large leaves, and

occasional white flowers with violet calyxes. Botanists have not determined whether *Salvia divinorum* is a cultigen or a hybrid; native plants reproduce vegetatively, rarely producing viable seed.
Its chief active psychoactive constituent is a structurally unique diterpenoid called *salvinorin A*, a potent κ-opioid and D_2 receptor agonist. *Salvia divinorum* is generally understood to be of low toxicity (high LD_{50}) and low addictive potential since it is a κ-opioid agonist. Salvinorin A is capable of inhibiting excess intestinal motility (e.g. diarrhea), through a combination of κ-opioid and cannabinoid (mainly CB_1 receptor) receptors in *inflamed* but not normal gut *in vivo*. The mechanism of action for Salvinorin A on ileal tissue has been described as 'prejunctional', as it was able to modify electrically induced contractions, but *not* those of exogenous acetylcholine[41]. Results from a small study by an assistant professor at the University of Iowa indicate that it may have potential as an analgesic and as a therapeutic tool for treating drug addictions[42]. A pharmacologically important aspect of the contraction-reducing (antispasmodic) properties of ingested Salvinorin A on gut tissue is that it is only pharmacologically active on *inflamed* and not normal tissue, thus reducing possible side-effects.

Fig 10: *Salvia*

Hibiscus sabdariffa is a species of *Hibiscus* native to the Old World tropics, used for the production of bast fibre. The plant is considered to have antihypertensive properties. Hibiscus, has been used in folk medicine as a diuretic, mild laxative, and treatment for cardiac and nerve diseases and cancer[43]. The heated leaves are applied to cracks in the feet and on boils and ulcers to speed maturation. A lotion made from leaves is used on sores and wounds. The seeds are diuretic and tonic in action and the brownish-yellow seed oil is claimed to heal sores on camels. In India, a decoction of the seeds is given to relieve dysuria, strangury and mild cases of dyspepsia. Brazilians attribute stomachic, emollient and resolutive properties to the bitter roots.

Fig 11: *Hibiscus sabdariffa*

Sesame is a flowering plant in the genus *Sesamum*. Numerous wild relatives occur in Africa and a smaller number in India. It is widely naturalized in tropical regions around the world and is cultivated for its edible seeds, which grow in pods. Sesame is very drought-tolerant. It has been called a survivor crop, with an ability to grow where most crops fail[44]. Sesame has one of the highest oil contents of any seed. With a rich nutty flavor, it is a common ingredient in cuisines across the world.

Fig 12: *Sesame*

Yucca: It is a perennial shrubs and trees in the family Asparagaceae. Its 40-50 species are notable for their rosettes of evergreen, tough, sword-shaped leaves and large terminal panicles of white or whitish flowers. Yuccas are widely grown as ornamental plants in gardens. Many species also bear edible parts, including fruits, seeds, flowers, flowering stems[45], and more rarely roots. References to yucca root as food often stem from confusion with the similarly pronounced, but botanically unrelated, yucca, also calledcassava (*Manihot esculenta*). Roots of soap tree yucca (*Yucca elata*) are high in saponins and are used as a shampoo in Native American rituals. Dried yucca leaves and trunk fibers have a low ignition temperature, making the plant desirable for use in starting fires via friction[46]. In rural Appalachian areas, species such as *Yucca filamentosa* are referred to as "meat hangers". The tough, fibrous leaves with their sharp-spined tips were used to puncture meat and knotted to form a loop with which to hang meat for salt curing or in smoke houses.

Fig 13 & 14: *Yucca*

Agave lechuguilla: It is an agave species found only in the Chihuahuan Desert, where it is an indicator species[47]. It typically grows oncalcareous soils[48]. The plant flowers once in its life, and then it dies. The flowers are a source of nutrients for insects, bats, and some birds. The leaves are long, tough and rigid, with very sharp, hard points which can easily penetrate clothing and even leather, giving the colloquial name "shin-daggers". Native Americans have used fibers from the leaves (commonly called *ixtle*, but also a hard fiber known by the trade name Tampico fiber) to make ropes and mats. Nowadays, Tampico fiber is also being used in the industrial brush business. It is resistant to most chemicals, alkaline and acidic solutions, heat, etc. The water stored in this plant, rich in salts and minerals, is sold in Mexico as a sport drink. The plant makes up a large part of the diet of the collared peccary in some areas[49]. It is toxic to cattle and sheep, however[50].

Fig 15: ***Agave lechuguilla***

1.2 Techniques used in extraction of nutraceuticals: There are different methods for extraction of these nutraceuticals; they include plant tissue homogenization, serial exhaustive extraction, Soxhlet extraction, maceration, decoction, Infusion, percolation, Sonication. All these methods help to extract the phytochemical substance for the screening.

1.3 Screening Methods: Screening methods helps to detect alkaloids, carbohydrates, glycosides, Saponins, Phytosteroids, phenols, tannins, Flavanoids, proteins and amino acids and Diterpenes.

1.4 Microbiological analysis for nutraceuticals: Total plate cont, Coliforms test, Testing yeast, Mold, Staphylococcs assay, Haemolysis and Salmonella assay etc.,

1.5 Analytical Techniques: Development of advanced analytical techniques is, therefore, indispensable in nutraceuticals research. It includes the identification of new nutraceuticals, characterization of nutraceuticals, their chemical structure and bioactivity, quantification in the natural source, product development, quality control in their dosage forms, etc., Due to their complexity of these natural matrices, the use of advanced analytical techniques such as MS, NMR, HPLC, GC, CE, HPLC-NM, HPLC-MS, GC-MS and CE-MS is mandatory in order to carry. Important aspects during product development should include nutraceuticals, bioactivity and bioavailability.

1.6 Role of Nutraceuticals in chronic diseases treatment:

Majority of the nutraceuticals do possess multiple therapeutic benefits, however much effort has been devoted to decentralize them based on their disease specific major indication. Nutraceuticals have been claimed to have a physiological benefit or provide protection against the following diseases and or found to act as follows:

II. CARDIOVASCULAR DISEASES

In CVD is the name for the group of disorders of the heart and blood vessels and include hypertension, coronary heart disease, cerebrovascular disease, heart failure, peripheral vascular diseases etc., Majority of the CVD are penetrable and controllable. Low intake of fruits and vegetables are associated with a high mortality in CVD. Nutraceuticals in the form of antioxidants, dietary fibers, Omega-3 polyunsaturated acids (n-3 PUFAs), vitamins and minerals are recommended together with physical exercise for prevention and treatment of CVD. There are possibilities to develop nutraceuticals to prevent and manage thrombosis risk in women with thrombophilic gene mutations.

Obesity: A well established risk factor for many disorders like angina pectoris, congestive heart failure, hypertension, hyperlipidemia, respiratory disorders, renal vein thrombosis, osteothritis, cancer, reduced fertility etc., A blend of gluco mannan, chitosan, fenugreek, G Silvestre and vitamin C in dietary supplement significantly reduced body weight and promoted fat loss in obese individuals. There is a high prevalence of obesity globally and hence nutrition and exercise play a key role in its prevention and treatment. Nutraceuticals like conjugated linoleic acid (CLA), Capsaicin, Momodica charantia (MC) and Psyllium fiber possess anti obese properties.

Diabetes: Diabetes mellitus is characterized by abnormally high levels of blood glucose, either due to insufficient insulin production or due to its ineffectiveness. Type I and Type Ii diabetes is associated with obesity. Dietary fibers from Psyllium have been used extensively both as pharmacological supplements, food ingredients in processed food to aid weight reduction, for glucose control in diabetic patients and to reduce lipid levels in hyperlipidemia. Good magnesium status reduces diabetes risk and improves insulin sensitivity,

chromium picolinate, calcium and vitamin D appear to promote insulin sensitivity and improve glycemic control in diabetes, extracts of bitter melon and of cinnamon have the potential to treat and possibly prevent diabetes. However, nutraceuticals with meaningful doses of combinations may substantially prevent and presumably cold be marketed legally.

III. CANCER

A healthy life style and diet can help in preventing cancer. People who consume large amount of lutein-rich foods such as spinach, tomatoes, oranges and leafy greens experienced the lowest incidence of colon cancer. At the molecular level, free radicals and aldehydes, produced during chronic inflammation, can induce deleterious gene mutation and post translational modifications of key cancer-related proteins. Ginseng as an example of an anti-inflammatory molecule that targets many of the key players in the inflammation to cancer sequence. So nutraceuticals play a great role in preventing cancer.

Inflammatory disorders: Inflammation is the response of body tissues to injury or irritation, characterized by pain and swelling and redness and heat. Arthritis is a general term that describes inflammation in joints. Rheumatoid arthritis shoulder tendinitis or bursitis gouty arthritis and polymyalgia rheumatic. Micro nutrients for which preliminary evidence of benefit exists include vitamin C and vitamin D. numerous nutraceuticals that may influence osteoarthritis pathophysiology, including glucosamine, chondroitin, sadenosylmethionine, ginger and avocado and soybean unsaponifiables. The nutraceuticals have both nutrient and pharmaceutical properties and seem to regulate gene expression and synthesis of NO and PGE2 providing a plausible explanation for their anti-inflammatory activities.

Allergy: Allergy is a condition in which the body has an exaggerated response to either a drug or food. Quercetin is rich source in onions, red wine and green tea. Histamines are responsible for allergic and inflammatory reactions. It can help reduce the inflammations that results from hay fever, bursitis, gout, arthritis and asthma. QR inhibits some inflammatory enzymes such as lipid peroxidases and decreases leukotriene formation. QR has an anti-inflammatory, antiviral, immune modulatory, anticancer and gastro protective activities. QR blocks an enzyme that leads to accumulation of sorbitol, when has been linked to nerve, eye, and kidney damage in those with diabetes. QR possesses potent antioxidant properties and promotes LDL cholesterol and prevents damage to blood vessels by certain forms of cholesterol and other chemicals produced by the body.

Degenerative diseases: The oxidative stress is etiologically related to a number of neurogenerative disorders including Alzhemier's disease. Neutraceutical antioxidants like beta carotene, curcumin, lutein, lycopene, turmerin etc may exert positive effects on specific diseases by neutralizing the negative effects oxidative stress, mitochondrial dysfunction and various forms of neural degeneration. The pathogenic events centered on metal ions are expected to be aggravated by frequent nutraceutical intake.

Chronic Lyme disease: It is a fast-spreading problem thought worldwide. It is caused by a bacterial spirochete called *Borrelia burgdorfei*. This disease is also known as Borrelia affects the immune system and lowers the white blood count and lessens the host's immunity. When the immune system becomes dysfunctional, the patients then infected with a multitude of secondary bacterial, fungal, mycoplasmal and viral infections. This disease affects the CNS, numbness, paralysis and strange abnormal sensations. The area most commonly affected is the brain and the face including teeth, jawbone, ears and sinuses. The symptoms are due to neurotoxins that are created by the organisms; these alter the host's immune system and make the host a comfortable environment for the proliferation of Borrelia and the co-infections. Neutraceutical helps to cue and treat the disease.

Miscellaneous: Good quality nutritional supplements can play a valuable role in the health of the pregnant mother and the baby emphasis must always be on eating a good diet.

IV. CONCLUSION

Nutraceuticals are currently receiving recognition as being beneficial in various health disorders. Neutral compounds action involve biological processes, including activation of antioxidant defenses, signal transduction pathways, cell survival-associated gene expression, cell proliferation and differentiation and preservation of mitochondrial integrity. They play a crucial role in the protection against the pathologies of numerous age related or chronic diseases. It is very imperative that the nutrients found in many foods, fruits and vegetables are responsible for the well documented health benefits. The nutraceuticals changing continually and reflects the market developments and consumer interest.

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