



NUTRACEUTICALS: AN OVERVIEW

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Abstract:

In recent years Nutraceuticals have been a boon because of their presumed safety and provide medical and health benefits. Nutraceuticals are also use for prevention and treatment of diseases. This article focused on need for nutraceuticals, their advantages, classification of large number of nutraceuticals available in various form, development of new nutraceuticalssuppliments, formulation and regulatory aspects of nutraceuticals.

Keywords: Nutraceutical, DietrySuppliment, Food Suppliment, Disease

INTRODUCTION:

Since the beginning of time, people have created medicines from natural extracts and employed them for a variety of purposes. The word "Nutraceuticals," which is a blend of nutrition and pharmaceuticals, was first used by Dr. Stephen in 1989. Since a new trend in companion animal care and related changes in the human population arose in the 1990s, nutraceuticals have advanced significantly. The definition of nutraceuticals has been expanded to cover vitamins, minerals, herbs and other botanicals, amino acids, and dietary substances for human use as a supplemental diet since the dietary supplement health and education act of 1994 was passed ⁽¹⁾. While dietary supplements are thought to be more prominent, the term "nutraceutical" is not fully accepted by global regulatory systems. There are currently more than 470 nutraceutical and functional food items with documented health benefits⁽²⁾.

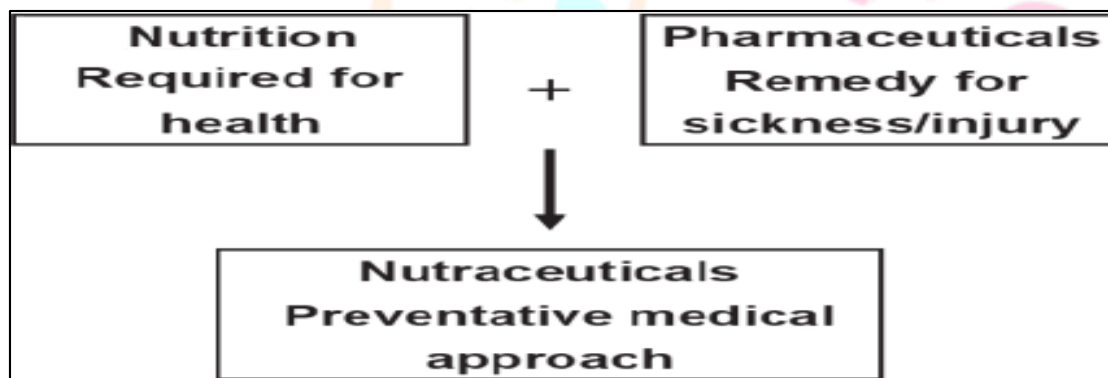
The art of balancing one food type's effect with another such that they all worked in harmony is largely responsible for the success of traditional therapies. Medical professionals are currently thought of as a magic wand that can cure disease. According to a recent survey, 70% of patients frequently seek medical advice before to or during traditional therapy, which shows that natural therapy is not preferred⁽³⁾. Nevertheless, patients are well aware of the adverse effects and contraindications brought on by chemical agents employed in both short- and long-term therapy. Us the desire to treat every minor ailment preventatively became popular, which

prompted new studies on complementary medicines, ideally using nutritional approaches. In this review, some key information about the therapeutic use of nutraceuticals as both conventional and commercial treatments is highlighted.

CONCEPTS OF NUTRACEUTICALS:

It is necessary for the pharmaceutical development process to have clinical test data from animal experiments and research in order to verify the effects. On the other hand, there was no technique of verification for foods' role in disease prevention in the past when it came to nutrition. However, in recent years, as food composition has been scientifically shown to induce diseases linked to a sedentary lifestyle, it has become a social issue. As shown in figure 1.

FIGURE 1: Concept of Nutraceuticals⁴



NEED FOR SHIFT TOWARDS NUTRACEUTICALS:⁵⁻¹⁰

1. Consumers are becoming more and more concerned about healthcare prices.
2. People who are dissatisfied with the effectiveness of pharmaceuticals in promoting health are turning to nutraceuticals to enhance their well-being and fend off chronic illness.
3. Health care professionals are aware that our overly processed food supply, which is made up of crops grown with the use of chemical fertilizers, pesticides, herbicides, and frequently genetically engineered seeds, lacks the essential nutrients for good health.
4. People priorities prevention over treatment.
5. Individuals with chronic illnesses for whom allopathic therapy has proven to be ineffective.
6. Economically challenged patients.

With few exceptions, the U.S. Food and Drug Administration (FDA) has not authorised nutraceuticals for use in treating illness or preventing it, despite marketing claims to the contrary by their producers.

REGULATORY ASPECTS OF NUTRACEUTICALS:The appropriate authorities must pay attention to India's regulatory framework for nutraceuticals. Globally, regulatory bodies adapt current rules to account for evolving consumer needs in order to safeguard consumers, but in India, outdated legislation, such as the

Prevention of Food Adulteration Act of 1954, which governs packaged foods, is still in effect for producers. They also have to follow a number of additional onerous laws, like:

- Standards of Weights and Measures Act, 1976, and the Standards of Weights and Measures.
- (Packaged Commodities) Rules, 1977 (SWMA)
- Infant Milk Substitutes, Feeding bottles and infant foods (regulation of production, Supply and Distribution) Act, 1992 with Rules, 1993 (IMS)
- Edible Oils Packaging (Regulations) Order, 1998
- Fruit Products Order 1955 (FPO)
- Meat product Order 1973
- Milk and Milk Products Order 1992
- Vegetable Oils Products (Regulation) Order 1998 (VOP)
- Atomic Energy Act, 1962 and Atomic Energy (Control or irradiation of Food) Rules 1996
- Consumer Protection Act 1986 and the Consumer Protection (Amendment) Act, 2002 and Rules 1987
- Environment Protection Act, 1986 and Rules 1986
- Agricultural Produce (Grading and Marking) Act, 1937 (as amended up to 1986) and 49
- General Grading and Marking Rules 1986 and 1988 (AG Mark)
- Bureau of Indian Standards (BIS) Act 1986

Furthermore, the classification of functional foods and nutraceuticals lacks precision. The confusion it causes among the regulators. The drug authorities occasionally struggle with the temptation to label these goods as drugs. It has caused problems for legitimate manufacturers. The outdated PFA will be replaced with a revolutionary measure called the Food Safety and Standards Act. A new act will lead India toward a new regulatory framework, preparing it for international competition⁽¹⁰⁾.

On the other hand, the Watershed Act, which governs the production and marketing of nutraceuticals in the United States, was passed in 1994. The Dietary Supplement Health and Education Act (DSHEA), a bill that reversed 45 years of rising FDA regulation of health-related items, was passed in the United States⁽¹¹⁾. The Food and Drug Administration Modernization Act of 1997 (FDAMA), which was passed, gave manufacturers of nutraceuticals more choices. The reform effort that led to this legislation lasted for almost two decades. It achieves balance in FDA regulations between approving therapeutic items so they can benefit patients and ensuring the safety and effectiveness of those products to protect the public health⁽¹²⁾. The Japanese Ministry of Health and Welfare established the "Foods for Specified Health Uses" (FOSHU) regulation in 1993, allowing some functional foods to make health claims under certain conditions. A new regulatory framework, the "foods with nutrient function claims" (FNFC) system, and the newly constituted FOSHU were adopted in 2001. Additionally, the government modified the FNFC, FOSHU, and other systems in 2005. These modifications include the addition of new FOSHU Subsystems like:

- Standardized FOSHU
- Qualified FOSHU
- Disease risk reduction claims for FOSHU⁽¹³⁾

REGULATORY AGENCIES FOR NUTRACEUTICALS:⁽¹⁴⁻¹⁸⁾

NAME OF COUNTRY	REGULATORY AUTHORITIES	DESCRIPTION
Japan Dietary supplements and natural nutraceuticals preferred as: “Foods with Health Claims”	<ol style="list-style-type: none"> 1. Food Safety Commission 2. Pharmaceutical Affairs and Food Sanitation Council, 3. The Ministry of Health, Labor and Welfare 4. Consumer Affairs Agency 5. Food of Special Health Uses (FOSHU) Act 6. Japan Health Food Association (JHFA) 7. Japan Health Food and Nutrition Food Association (JHNFA) 	<p>For regulatory purposes, nutraceuticals are divided into two groups.</p> <ol style="list-style-type: none"> 1. “Foods with Nutrient Function Claims,” contains twelve vitamins and five minerals. 2. “Foods for Specified Health Uses,” or FOSHU.
Israel Innovation hub for the nutraceutical industry	<ol style="list-style-type: none"> 1. Ministry of Health (MoH) 	<p>The industry is driven by ingredient companies such as Solbar Industries, LycoRed NaturalIngredients, Adumim Food Ingredients, Enzymotec, Algatechnologies and Frutarom etc.</p>
China	<ol style="list-style-type: none"> 1. China Health Care Association (CHCA) 2. China’s State Food and Drug Administration (SFDA) 3. US-China Health 	<ol style="list-style-type: none"> 1. SFDA: In harge of dietary supplements and issue registration 2. Ministry of Health (MOH): approval of new novel food ingredients

	<p>Products Association (USCHPA)</p> <p>4. Ministry of Health (MOH)</p> <p>5. Administration of Quality Supervision Inspection and Quarantine (AQSIQ)</p>	<p>3. Administration of Quality Supervision Inspection and Quarantine (AQSIQ): controls over imports and exports</p>
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<p>India</p>	<ol style="list-style-type: none"> 1. Food Safety and Standards Act (FSSA) 2. Indian Pharmacopoeia 3. Federation of Indian Chambers of Commerce and Industry (FICCI) 4. Centre for Food Safety and Applied Nutrition (CFSAN) 5. HADSA (Health Food and Dietary Supplements Association) 6. NIN (National Institute of Nutrition) 7. FDTRC (food and Drug Toxicology Research Centre) 8. NNMB (National Nutrition Monitoring Bureau) 9. Indian Health Foods and Dietary Supplements Association (INHADSA). 10. Indian Council of Medical Research (ICMR) 11. The Food Safety & Standards Authority of India (FSSAI). 	<ol style="list-style-type: none"> 1. FSSA: food and nutraceutical safety and standards. Also regulates manufacture, storage, distribution, sale and import. 2. Indian Pharmacopoeia: Standards for safety and quality like for plant extracts and phytochemicals 3. Federation of Indian Chambers of Commerce and Industry (FICCI): Improved regulatory framework to validate product claims which meets consumer demand 4. CFSAN: Diverse process of New Dietary Ingredient (NDI) 5. NIN: Focused studies on protein energy malnutrition, nutrition situation, methods of management and prevention of nutritional problems, . NIN is working under the aegis of 6. FDTRC: Study drug nutrient interactions (drug
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		metabolism, toxicity, valuate, identify naturally occurring food ingredients which are rich in antioxidants hypoglycemic hypolipidemic and cancer prevention)
Mexico	<ol style="list-style-type: none"> 1. National Association of Food Supplements Industry (ANAISA) 2. The Federal Commission for Protection against Health Risks (COFEPRIS) 	General Health Act defines dietary supplements as “herbal products, plant extracts, traditional foods, dehydrated or concentrated fruit added or not, vitamins or minerals that may arise in a pharmaceutical form and intended use is to increase total dietary intake, supplement it or replace some component of one’s diet.”
Brazil	<ol style="list-style-type: none"> 1. Brazilian Association of Foods for Special Purposes and Congeners (ABIAD). 2. Committee for Scientific and Technical Assessment of Functional and New Foods (CTCAF) 3. National Health Surveillance Agency (ANVISA) 4. Ministério da Agricultura, Pecuária e Abastecimento (MAPA) 	<ol style="list-style-type: none"> 1. ANVISA: Registration and regulation of new products 2. National Policy of Integrative and Complementary Practice (PNPIC) in the Unified Health System (SUS): research and use of medicinal plants and herbal medicines according quality, safety and efficacy statements.
United States	<ol style="list-style-type: none"> 1. FDA 2. United States Department of Agriculture (USDA) 	Dietary supplement contain: a herb or other botanical or a concentrate, metabolite,

	3. DSHEA 4. Federal Trade Commission (FTC)	constituent, extract or combination of any ingredient from the other categories. Regulatory bodies evaluate, investigate, regulate, inspect and sanction.
European Union	1. European Food and Safety Authority (EFSA).	Food supplements are defined as concentrated sources of nutrients and other substances with a beneficial nutritional effect.
UK+	1. Food Standards Agency (FSA) 2. Medicines and Healthcare products Regulatory Agency (MHRA)	Guidelines for safe levels of intake for vitamins and minerals.
Malaysia	1. National Pharmaceutical Control Board (NPCB) 2. Drug Control Authority (DCA)	All claims are product specific and are subject to a pre-market approval of the National Pharmaceutical Control Bureau (NPCB)
Russia	1. Ministry of Health and Social Development 2. Federal Service on Supervision in Sphere of Public Health Services and Social Development (Roszdravnadzor)	1. Nutraceuticals are regulated under the term Biologically Active Dietary Supplements (BADs). They are recommended prophylactically and for the prevention of pharmaceutical therapy induced side-effects and the achievement of complete remission. 2. Roszdravnadzor: register and issues Registration Certificate

Canada

1. Food and Drug Authority

1. Natural Health Product

	2. Natural Health Product Regulations 3. Canadian Food inspection agency	Regulations: set requirements for efficacy, safety and quality reviews and provide Natural Product Number (NPN) 2. Products regulated under the Food and Drug Regulations (FDRs) 3. Canadian Food Inspection Agency: Regulate labelling and advertising 4. National Health Products Directorate (NPHD): evaluates product licence applications
Australia	Department of Health and ageing	
Australia New Zealand	Australia New Zealand Therapeutic Products Authority (ANZTPA)	1. ANZTPA: Authority over complementary and alternative medicines, including dietary supplements (nutraceuticals)
Republic of Korea	Korean Food and Drug Administration (KFDA)	KFDA: Evaluates toxicity tests, efficacy, human studies, safe use of product

Global food and nutrition bodies are:

1. WHO (World Health Organization)
2. CODEX (Codex Alimentarius)
3. WTO (World Trade Organization)
4. FAO (Food and Agriculture Organization).

Various schedules for food and nutraceuticals: ⁽¹⁸⁾

Schedule	Ingredients	Examples with dose
Schedule I	1. Vitamins 2. Minerals	1. Vitamin A: 30 % 2. Vitamin B: B1 /B2/B6/B12: 25%; B3:10% 3. Vitamin C: 20 % 4. Vitamin D: 30 % 5. Vitamin E: 10 % 6. Vitamin K1: 30 % 7. Pantothenic acid: 10% 8. Folic acid: 25% 9. Minerals: 10% 10. Iodine: 20%
Schedule II	1. Essential amino acids 2. Non-essential Amino acids 3. Nucleotides	1. Vitamin A: 35-100µg/100kcal 2. Vitamin B: B1: 0.06-0.5 mg/kcal B2: 0.08-0.5 mg/kcal B6: 0.08-0.5 mg/kcal B12: 0.07-0.7 mg/kcal B3: 0.9-3mg/100kcal 3. Vitamin C: 2.25-22 mg/100kcal 4. Vitamin D: 0.5-2.5µg/100kcal 5. Vitamin E: 0.5-3mg/100kcal 6. Vitamin K: 3.5-20µg/100kcal 7. Pantothenic acid: 0.15-1.5mg/100kcal 8. Folic acid: 10-50µg/100kcal 9. Minerals: 1. Sodium:30-175 mg / 100kcal 2. Chloride: 30-175mg /

		<p>100kcal</p> <p>3. Potassium: 80-295mg / 100kcal</p> <p>4. Phosphorous: 80-295mg / 100kcal</p> <p>5. Iron: 0. 5-2 mg / 100kcal</p> <p>6. Zinc: 0. 5-1. 5mg / 100kcal</p> <p>7. Copper: 60-500µg / 100kcal</p> <p>8. Iodine: 6. 5-35µg / 100kcal</p> <p>9. Selenium: 2. 5-10µg / 100kcal</p> <p>10. Manganese: 0. 05-0. 5mg / 100kcal</p> <p>11. Chromium: 1. 25-15µg / 100kcal</p> <p>12. Molybdenum: 3. 5-18 µg / 100kcal</p>
Schedule III	<p>These elements allowed to be used for special dietary use or medical purpose (other than those intended for use in infant formula)</p> <p>1. Vitamins</p> <p>2. Minerals</p> <p>3. Trace elements</p>	<p>Vitamins</p> <p>1. Vitamin A: 35-180 µg / 100kcal</p> <p>2. Vitamin D: 0. 5-2. 5µg / 100kcal</p> <p>3. Vitamin K: 3. 5-20µg / 100kcal</p> <p>4. Vitamin C: 2. 25-22µg / 100kcal</p> <p>5. Vitamin B6 or Riboflavin: 0. 08-0. 05µg / 100kcal</p> <p>6. Vitamin B12: 0. 07-0. 7µg / 100kcal</p> <p>7. Folic acid: 10-50µg / 100kcal</p> <p>8. Biotin: 75-7. 5µg / 100kcal</p>

		<p>Minerals</p> <ol style="list-style-type: none"> 1. Sodium: 30-175 mg / 100kcal 2. Chloride: 30-175mg / 100kcal 3. Potassium: 80-295mg / 100kcal 4. Phosphorous: 80-295mg / 100kcal 5. Iron: 0. 5-2 mg / 100kcal 6. Zinc: 0. 5-1. 5mg / 100kcal 7. Copper: 60-500µg / 100kcal 8. Iodine: 6. 5-35µg / 100kcal 9. Selenium: 2. 5-10µg / 100kcal 10. Manganese: 0. 05-0. 5mg / 100kcal 11. Chromium: 1. 25-15µg / 100kcal 12. Molybdenum: 3. 5-18 µg / 100kcal
Schedule IV	It includes plant or plant ingredients	<ol style="list-style-type: none"> 1. Acacia catechu, Gumor Stem bark: 5-10 gm per day 2. Adhatodazeylanica/ vasaka: Leaf, root, flower 5-10 gm 3. Alpinia galangal: Rhizome 2-4 gm 4. Allium sativum: bulb 3-6 gm; leaf 20-40 gm 5. Aloe vera/ ferox/barbadensis: Leaf 5-10 gm; dry leaf juice 0. 5-1 gm
Schedule VA	Food addatives for health	<ol style="list-style-type: none"> 1. Benzoates: 2000 mg/kg

	supplements, nutraceuticals, Probiotics and prebiotics	<ol style="list-style-type: none"> 2. Castor oil: 1000 mg/kg 3. Polyethylene glycol: 70, 000 mg/kg 4. Polysorbates: 25, 000 mg/kg 5. Saccharins: 1200 mg/kg
Schedule VB	Food additives for special dietary food, Probiotics and prebiotics	<ol style="list-style-type: none"> 1. Aspartame: 1000 mg/kg 2. Carotenoids: 300 mg/kg 3. Riboflavin: 300 mg/kg 4. Phosphate: 2200 mg/kg 5. Grape skin extract: 300 mg/kg
Schedule VC	Food additives for special medical purpose food, food with Probiotics / prebiotics	<ol style="list-style-type: none"> 1. Brilliant blue FCF: 50 mg/kg 2. Indigo carmine: 50 mg/kg 3. Sunset yellow FCF: 50 mg/kg 4. Sucralose: 400 mg/kg 5. Steviol glycosides: 350 mg/kg
Schedule VD	Food additives for special medical purpose food other than infant food, food with Probiotics / prebiotics, food for slimming and weight reduction	<ol style="list-style-type: none"> 1. Acesulfame potassium: 450 mg/kg 2. Ascorby ester: 500 mg/kg 3. Riboflavins: 300 mg/kg 4. Sorbates: 1500 mg/kg 5. Diacetyltartaric and fatty acid ester of glycerol: 5000 mg/kg
Schedule VE	Food additives to be used at GMP for special medical purpose food other than infant food, special medical purpose food, food with Probiotics / prebiotics, food as health supplements, nutraceuticals, food containing	<ol style="list-style-type: none"> 1. Acetic acid: Acidity regulator 2. Agar: Bulking agent, Gelling agent, Glazing agent, Humectant, Stabilizer, thickener, carrier, emulsifier. 3. Alginic acid: Bulking agent, Gelling agent,

		<p>Glazing agent, Humectant, Stabilizer, thickener, carrier, emulsifier, Foaming agent, Sequestrant.</p> <p>4. Alfa amylase: Flour treatment</p> <p>5. Beet red: Colour</p>
Schedule VI	Ingredients as a nutraceuticals	<p>Maximum permitted level</p> <p>1. Citrus bioflavonoids: 150-600 mg/day</p> <p>2. Lactase / Beta galactosidase: 3000-9000IU/day</p> <p>3. Piper nigrum/longa extract: 15mg/day</p> <p>4. Siberian ginseng: 100-450 mg/day</p> <p>5. Vaccinium myrstillus extract/ bilberry extract: 50-600 mg/day</p>
Schedule VII	List of microorganism as a probiotics. These microorganism use as a single or in combination but must declare on label with information about Non-GMO.	<p>1. Lactobacillus acidophilus</p> <p>2. Bacillus coagulans</p> <p>3. Bifidobacterium bifidum</p> <p>4. Streptococcus thermophilus</p> <p>5. Saccharomyces cerevisiae</p>
Schedule VIII	List of prebiotic compounds	<p>1. Polydextrose</p> <p>2. Inulin</p> <p>3. Lactulose</p> <p>4. Lactoferrin</p> <p>5. Sugar alcohols</p>

CATEGORIES OF NUTRACEUTICALS:

Nutraceuticals are general biological medicines that are used to improve health, stop cancerous processes, and manage symptoms. The following categories apply to them⁽¹⁹⁾

1. Based on chemical constituents

(a) Nutrients:

Vitamins, minerals, amino acids, and fatty acids are examples of substances with well-established nutritional purposes⁽²⁰⁾.

(b) Herbals:

Herbs or botanical products as concentrates and extracts⁽²¹⁾

(c) Dietary Supplement:

Products containing a dietary element intended to enhance the flavor of the food you consume are called dietary supplements and are delivered orally. Ginkgo biloba, black cohosh, and glucosamine/chondroitin are a few examples of dietary supplements. Black cohosh is used to treat menopausal symptoms. Additionally, it performs specific tasks like serving as a meal replacement, a supplement for weight loss, and for sports nutrition. Elements in supplements might include amino acids, enzymes, organ tissues, gland extracts, vitamins, minerals, herbs, and other botanicals. They can also include other nutritional ingredients. They can be obtained in a variety of dosage forms, such as tablets, capsules, liquids, powders, extracts, and concentrates⁽²²⁾

2. Traditional and Non- Traditional nutraceuticals:

There is a huge selection of traditional and non-traditional meals that are considered nutraceutical foods on the market.

(a) Traditional Nutraceuticals:

Traditional nutraceuticals include foods that have not been altered in any way; they are just natural, whole foods with updated knowledge of their potential health benefits. Other than how they are perceived by the consumer, there has been no change to the foods themselves. As an example, lycopene in tomatoes, omega-3 fatty acids in salmon, and saponins in soy are just a few examples of natural ingredients that many fruits, vegetables, grains, fish, dairy, and meat products contain and that provide benefits beyond merely nutritional value. According to certain research, even tea and chocolate have health-promoting properties. Researchers have discovered that salmon and tomatoes both contain nutrients that go beyond just providing basic sustenance, specifically lycopene and omega-3 fatty acids.

(b) Nontraditional Nutraceuticals:

They are products of agricultural breeding or contain extra nutrients and/or components. Nontraditional nutraceuticals include orange juice fortified with calcium, cereals with added vitamins or minerals, and flour with added folic acid. Agricultural experts have successfully developed methods to increase the nutritional value of several crops. There is now research being done to enhance the nutritional value of many other crops⁽²³⁾.

3. Based on Diseases:

TYPES OF DISEASES	NUTRACEUTICALS USE
Cardiovascular diseases	Anti-oxidants, Dietary fibres, Omega-3 poly unsaturated fatty acids, Vitamins, minerals for prevention and treatment of CVD. Polyphenol (in grape) prevent and control arterial diseases ⁽²⁴⁾ . Flavonoids (in onion, vegetables, grapes, red wine, apples, and cherries) block the ACE and strengthen the tiny capillaries that carry oxygen and essential nutrients to all cells ⁽²⁵⁾ . Ethyl esters of n-3 fatty acids may be beneficial in diabetic patients ⁽²⁶⁾ .
Diabetes	Docosahexaenoic acid modulates insulin resistance and is also vital for neurovisual development ⁽²⁷⁾ . Lipoic acid, an antioxidant, for treatment of diabetic neuropathy ⁽²⁸⁾ . Dietary fibers from psyllium have been used for glucose control in diabetic patients and to reduce lipid levels in hyperlipidemia ⁽²⁹⁾ . Obesity Herbal stimulants, such as ephedrine, caffeine, mahuanguarana, chitosan and green tea help in body weight loss ⁽³⁰⁾ . Buckwheat seed proteins acting similar to natural fibers present in food ⁽³¹⁾ .
Obesity	5-hydroxytryptophan and green tea extract may promote weight loss, while the former decreases appetite, the later increases the energy expenditure ⁽³²⁾ . A blend of glucomannan, chitosan, fenugreek, G sylvestre, and vitamin C in the dietary supplement significantly reduced body weight ⁽³³⁾ . Conjugated linoleic acid (CLA), capsaicin, Momordica Charantia

	(MC) possesses potential anti obese properties ⁽³⁴⁾ .
Cancer	Flavonoids which block the enzymes that produce estrogen reduce of estrogen-induced cancers ⁽³⁵⁾ .To prevent prostate/breast cancer a broad range of phyto-pharmaceuticals with a claimed hormonal activity, called “phyto-estrogens” is recommended ⁽³⁶⁾ .Soyfoods source of isoflavones, curcumin from curry and soya isoflavones possess cancer chemopreventive properties ⁽³⁷⁾ .Lycopene concentrates in the skin, testes, adrenal and prostate where it protects against cancer ⁽³⁸⁾ . Saponins (found in peas, soybeans, some herbs, spinach, tomatoes, potatoes, alfalfa and clover) contain antitumor and anti-mutagenic activities ⁽³⁹⁾ .Curcumin (diferuloylmethane) which is a polyphenol of turmeric possesses anticarcinogenic, antioxidative and anti-inflammatory properties ⁽⁴⁰⁾ .Top of Form Beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes, were reported to possess antitumor activity ⁽⁴¹⁾ .
Anti-inflammatory activities	Glucosamine and chondroitin sulfate are used against osteoarthritis and regulate gene expression and synthesis of NO and PGE2 ⁽⁴²⁾ .Cat’s claw has 17 alkaloids, along with glycosides, tannins, flavonoids, sterol fractions, and other compounds and work as potent anti-inflammatory agent ⁽⁴³⁾ .
Allergy	Quercet (found in Onions, red wine and green tea) reduce the inflammation that results from hay fever, bursitis, gout, arthritis, and asthma ⁽⁴⁴⁾ .

4.Probiotic Microorganisms:

They work to eliminate pathogens like yeasts, other bacteria, and viruses that may otherwise cause disease and form a beneficial symbiosis with the human digestive system. Through altering the microflora, preventing pathogen adhesion to the intestinal epithelium, competing for nutrients required for pathogen survival, producing an antitoxin effect, and reversing some of the effects of infection on the intestinal epithelium, such as secretory changes and neutrophil migration, they have an antimicrobial effect. By producing the exact enzyme (β -galactosidase) that can hydrolyze the problematic lactose into its component sugars, probiotics can treat lactose intolerance. The following safety, functional, and technological factors should be taken into account when choosing probiotics: Show a possible health benefit.

- Probiotics should have human origin.
- Commonly gram positive organism.
- Can survive after passage through acid and bile.
- Can adhere to the human intestinal cells and grow in the gut.
- Can show antagonist action against pathogenic or carcinogenic bacteria.
- Clinically proven documented beneficial health effects⁽⁴⁵⁾.

5. Prebiotics:

Prebiotics, which are compounds that we do not digest when we take them, are a more recent term to enter our lexicon. The beneficial probiotic bacteria use them as a source of nutrients instead. As a result, there is less possibility of harmful microorganisms beginning to proliferate in our digestive tract because the probiotic bacteria are encouraged to flourish in a favourable environment. Historically, processed foods have exploited the prebiotic inulin extensively. In essence, it's a form of fibre made from the roots of plants like chicory, Jerusalem artichoke, and even weeds like dandelions⁽⁴⁶⁾.

6. Nutraceutical Enzymes:

Without enzymes, life would not be possible and our bodies would stop working. Adding enzyme supplements to one's diet can help patients with medical diseases like hypoglycemia, blood sugar imbalances, digestive issues, and obesity get rid of their symptoms. These enzymes come from animal, plant, and microbial origins⁽⁴⁶⁾.

7. Fortified nutraceuticals:

They are often enhanced with vitamins and minerals up to 100% of the Dietary Reference Intake for each nutrient. It is food that has been enhanced through agricultural breeding, the addition of nutrients, or the addition of folic acid to ingredients. Cholecalciferol-fortified milk is one illustration that is used to treat vitamin D insufficiency.

8. Recombinant nutraceuticals:

Biotechnology is used to make foods that provide energy, including bread, wine, fermented starches, yoghurt, cheese, vinegar, and others. Biotechnology enables the creation of probiotics, the enzyme/fermentation-based extraction of bioactive components, and genetic engineering technology.

9. Commercial Nutraceuticals:

Finding new molecules now is more expensive, dangerous, and complex than ever before. There is no doubt that there is a very large and expanding market for nutraceuticals, which is why many pharmaceutical companies are now attempting to produce them. The majority of therapeutic areas are covered by nutritional supplements, including arthritis, cold and flu, sleeping issues, digestion, and the prevention of certain

malignancies, osteoporosis, blood pressure, cholesterol control, painkillers, depression, and diabetes. One of the most encouraging advancements in human nutrition and disease prevention research over the past three decades is the recognition of the health advantages associated with the eating of omega-3 rich seafood.

- Dietary supplements,
- Functional food,
- Medicinal food,
- Pharmaceuticals⁽⁴⁷⁾.

10. Medicinal food and Function food:

(a) Medicinal food:

A food that is specifically designed to be consumed or administered internally under the guidance of a doctor and intended for the specific dietary management of a disease or condition for which distinctive nutritional requirements, based on acknowledged scientific principles, are established by medical evaluation also excludes any ingredients that encourage disease condition or contain a specific nutrient that the body cannot normally process. It is given by doctors for a variety of medical disorders such as phenylketonuria, coeliac disease, and lactose intolerance that result in poor ingestion, digestion, absorption, or metabolism of conventional diets⁽⁴⁸⁾.

(c) Function food:

Functional foods are defined as "any food or food ingredient that may provide a health advantage beyond the traditional nutrients it provides" in accordance with their generally recognized definition. Instead than taking nutritional supplements that are produced in liquid or capsule form, functional foods are intended to allow consumers to eat enriched meals that are near to their original state. Nutrification is the process of enhancing or fortifying functional foods. By using this technique, the nutritional content of a product is returned to levels that were there before the food was processed. In some cases, complimentary extra nutrients are given, like vitamin D to milk.

Health Canada defines functional foods as "ordinary food that has components or ingredients added to give it a specific medical or physiological benefit, other than a purely nutritional effect. In Japan, all functional foods must meet three established requirements: foods should be.

1. Present in their naturally occurring form, rather than a capsule, tablet, or powder.
2. Consumed in the diet as often as daily; and.
3. Should regulate a biological process in hopes of preventing or controlling disease⁽⁴⁹⁾.

CONCLUSION:

All the necessary components for a human's healthy diet are provided by nutraceuticals. Various chemical components from natural sources can be gathered and produced into a variety of optimal, secure, and stable

formulations for the treatment and diagnosis of disorders, according to the study mentioned above. The food and pharmaceutical industries both employ nutraceuticals extensively. Numerous nutraceuticals, including gamma terpinenes, beta carotene, curcumin, limonene, eugenol, pinene, safranal, geraniol, aloin, caryophyllin, lycopene, and silymarin, are either of mineral, animal, or vegetable origin. These ingredients are prepared into topical and oral dosage forms, including creams, lotions, ointments, emulsions, unani formulations, aromatic oils, microemulsions, SMEDDS, beads, tablets, and emulgels. They are used in a variety of categories, including antidiabetic, antibiotic, antimicrobial, anti-inflammatory, anti-cancer, protective, etc. data from the study indicate that demand and consumption of nutraceuticals are now going on increasing due to safety, therapeutic efficacy, stability of formulations.

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