



Nutraceuticals: A promising trend in herbal industry

Margret Chandira*, D Ayeswarya, J Joypetrisha, P Palanisamy

Department of Pharmaceutics, Vinayaka Mission's College of Pharmacy, Vinayaka Mission's Research Foundation (Deemed to be University), Ariyanur, Salem, Tamil Nadu, India

Abstract

Nutraceuticals refers to food sources medicinally affecting well-being of people. It comprise of food supplements, natural items, probiotics and prebiotics, clinical food sources implied for avoidance and treatment of infections. Major nutraceuticals have various restorative impact with lacking of undesirable impacts henceforth draw in more shopper interest. Expansion in shift towards preventive treatments and expanding extra cash, ideal estimating climate development in pharma corporate store and expansion in medical care spending is mostly liable for expanding market for nutraceuticals in India, however absence of normalization and mindfulness, high evaluating, advertising and appropriation are a few difficulties. Nutraceutical market is seeing flowing development chiefly in United States, India and European nations. Quicker admittance to this market is conceivable through business association models, compelling administrative consistence and by assessing key patterns and buyer reference.

Keywords: nutraceuticals, traditional nutraceuticals, recombinant nutraceuticals, herbals, medicinal food sources, therapeutic benefits

Introduction

A nutraceuticals word is includes 'Supplement' and 'Drugs'. As indicated by AAFCO, 1996, 'Supplement' signifies a feed constituent in a structure and at a level that will help, support an existence of individual or creature while 'Nutraceutical' signifies any non-poisonous food part that has experimentally demonstrated medical advantages including avoidance and therapy of illness. Items disconnected or cleansed from food are sold in therapeutic structures not as a rule related with food. A nutraceutical have a physiological advantage that it gives security against persistent illnesses. Nutraceutical practical food market in United States is 250 billion US\$ while drug market is 150 billion US\$. Every year around 1000 new items coming in market, and around 29,000 dietary enhancements accessible in US In Britain, the Ministry of Agriculture, Fisheries and Food has fostered a meaning of a practical food as "a food that has a part fused into it to give it a particular clinical or physiological advantage, other than simply healthful advantage. There is a slight contrast between the useful food sources and nutraceuticals. At the point when food is being cooked or arranged utilizing "logical insight" with or without information on how or why it is being utilized, the food is classified "useful food". Instances of nutraceuticals incorporate sustained dairy items (for example milk) and citrus natural products (for example squeezed orange).

History^[4-6]

The idea of Nutraceuticals returned similarly as 3000 years prior. Hippocrates (460–377 B.C) expressed 'let food be thy medication and medication be the food '. In the mid1900s the United States of America food makers began adding little amount of iodine to salt to forestall goiter. The term nutraceuticals was begat in 1989 by Stephen DeFelice who was the Chairman and Founder of the Foundation for Innovation in Medicine, Cranford, New Jersey. As per De

Felice, nutraceutical can be supposed to be "a food (or part of a food) that gives clinical or medical advantages, including the counteraction as well as therapy of an infection." However, the term nutraceutical as normally utilized in promoting has no administrative definition.

In England, Japan and different nations, nutraceuticals are as of now turning out to be important for dietary scene. Diet was first considered by Germany, France and O. K. Nwosu and K. I. Ubaoji 15 the United Kingdom as a more significant factor than practice or innate factors in accomplishing great wellbeing. Canada characterized them as 'result of food sources however sold in pills, powders, (elixirs) and other restorative structures not regularly connected with food'.

In India, nutraceuticals are viewed as the food parts produced using natural or herbal unrefined substances, which are utilized for forestalling or treating various sorts of ongoing and intense diseases. These days, nutraceuticals are one of the most quickly developing portions of the business with a normal build yearly development rate (CAGR) of 7.5%. The worldwide nutraceutical market is assessed to increment from \$241 billion market in 2019 to \$373 billion out of 2025. The clear utilization of nutraceuticals has been to accomplish advantageous remedial results with diminished incidental effects. Natural Nutraceuticals are amazing instruments in supporting wellbeing and act in opposition to healthfully incited intense and constant infections by advancing ideal wellbeing, life span and personal satisfaction.

Classification^[7]

Nutraceuticals or practical food sources can be grouped based on their sources: normal or conventional and unnatural or non-customary.

- Based on natrual source, it very well may be named the items acquired from plants, creatures, minerals, or

microbial sources. This order can be alluded to as Traditional Nutraceuticals.

- b. Nutraceuticals as pre-arranged by means of biotechnology: this grouping can be alluded to as Non-Traditional Nutraceuticals.

Traditional Nutraceuticals ^[8,9]

They are normal items without any progressions to the food. They contain various normal parts that pass on benefits past essential nourishment, similar to omega-3 unsaturated fats in salmon, saponins in soy or lycopene in tomatoes. The conventional nutraceuticals can be isolated based on:

- a. Chemical Constituents.
 - Nutrients.
 - Herbals.
 - Phytochemicals.
- b. Nutraceutical Enzymes.
 - Chemical Constituents.
- c. Probiotic Microorganisms

Nutrients ^[10]: The supplements incorporate amino acids, unsaturated fats, minerals and nutrients with perceived wholesome capacities. Most food varieties contain nutrients that guide in restoring sicknesses like stroke, waterfalls, osteoporosis and heart illnesses. Minerals found in plants, creatures and dairy items are valuable in osteoporosis, pallor and in building solid bones, teeth, muscles, and further develop nerve motivations and heart musicality.

Herbals ^[11]: Herbal nutraceuticals help to further develop wellbeing and deflect persistent sicknesses. The majority of these are pain relieving, calming, astringent, antipyretic and hostile to ligament. A portion of the herbals contain flavonoids like apiol, psoralen that are diuretic, carminative and antipyretic. Peppermint (*Menthapiperita*) contains menthol as a functioning part that helps fix cold and influenza.

Phytochemicals ^[12]: Phytochemicals are plant supplements with specific organic exercises that advance human wellbeing. They are additionally alluded to as Phytonutrients. They work by filling in as substrate for biochemical responses cofactors or inhibitors of enzymatic responses, sponges that tight spot to and destroy undesirable constituent in the digestive system and work on the assimilation and additionally steadiness of vital supplements among others.

Nutraceutical Enzymes ^[13]: These are proteins that are gotten from plant, creature and microbial sources. Compounds are a fundamental piece of life, without which our bodies would stop to work ideally. Ailments, for example, glucose issues, stomach related issues and

corpulence have their side effects wiped out by chemical enhancements in the eating regimen.

Probiotic Microorganisms ^[14]: Probiotics signify 'forever'. They are characterized as live microorganisms, which when devoured in average sums, present a wellbeing impact on the host. These microorganisms are responsive microscopic organisms that advance solid assimilation and ingestion of certain supplements.

Non-Traditional Nutraceuticals ^[15]

These are the counterfeit food sources created through biotechnology. The bioactive parts in food tests are designed to deliver items for human-wellbeing. They can be gathered into invigorated nutraceuticals and recombinant nutraceuticals

Fortified Nutraceuticals ^[16]: These are nutraceuticals from agrarian rearing or added supplements or potentially fixings. Models incorporate grains with added nutrients or minerals, milk invigorated with cholecalciferol utilized in nutrient D insufficiency, flour with added folic corrosive, prebiotic and probiotic strengthened milk with *Bifidobacteriumlactis* HN019 utilized in the runs, respiratory diseases and serious ailments, in youngsters and squeezed orange sustained with calcium.

Recombinant Nutraceuticals ^[17]: Recombinant nutraceuticals incorporate the creation of probiotics and the extraction of bioactive parts by chemical/maturation advances just as hereditary designing innovation. Additionally energy-giving food varieties, like bread, liquor, matured starch, yogurt, cheddar, vinegar, and others are created utilizing present day biotechnology. Models incorporate cows with lactoferrin 2 Nutraceuticals: History, Classification and Market Demand 18 lack is designed with recombinant human lactoferrin (rhLf) to have the option to settle the lactoferrin insufficiency.

Herbals as Nutraceuticals ^[18]

Spices assume a critical part in the support of the nature of human existence through the plentiful wellspring of bio-constituents.

The natural bioactive constituents are a fundamental classification of nutraceuticals which have a lot of wellbeing advancing therapeutic properties notwithstanding minerals, nutrients and other dynamic mixtures. The spices harbor a far and wide assortment of dynamic phytochemicals like flavonoids, terpenoids, saponin, and polyphenols. These home grown bioactives are most occasions usually utilized by individuals who look for traditional medical services as a food supplement. In such manner, it is viewed as utilizing spices as nutraceutical.

Common Herbals used as Nutraceuticals ^[19-21]

Table 1

Si.no	Biological name	Common name	Part of the plant	Bioactive compounds	Benefits to health
1.	<i>Zingiber officinale</i> (Zingiberaceae.)	Ginger	Rhizomes	Zingiberene and gingerols	Hyperglycemia, chronic bronchitis, stimulant and throat ache
2.	<i>Panax ginseng</i> (Araliaceae)	Ginseng	Root	Ginsenosides and panaxosides	Stimulating immune and nervous system

3.	Allium sativum (Liliaceae)	Garlic	Bulbs	Allin and allicin	Antibacterial, antiinflammatory, antifungal, antigout, antithrombotic, hypotensive, antihyperlipidemic
4.	Aloe barbadensis Mill. (Liliaceae)	Aleo vera	Gel	Aloins and aloesin	Dilates capillaries, anti-inflammatory, emollient, wound healing properties
5.	Curcuma Longa (Zingiberaceae)	Turmeric	Rhizome	Curcumin	Anticancer, antiinflammatory, antiseptic, antiarthritic.
6.	Allium cepa Linn. (Liliaceae)	Onion	Bulb	Allicin and allin	Hypoglycemic activity, antibiotic and antiatherosclerosis
7.	Ginkgo biloba (Ginkgoaceae)	Maiden hair tree	Leaves	Ginkgolide and bilobalide	Antioxidant, memory enhancer, increased peripheral blood flow, treatment of postthrombotic syndrome
8.	Cassia angustifolia (Leguminosae)	Senna	Leaves	Sennosides	Purgative
9.	Echinacea purpurea (Asteraceae)	Echinacea	Leaves	Alkylamide and echinacoside	Antiviral, antiinflammatory and immunomodulator
10.	Glycyrrhizaglabra (leguminosae)	Liquorice	Root	Glycyrrhizin and liquirtin	Anti-inflammatory and anti-allergic.

Herbal nutraceutical safety and regulation ^[22, 23]

The cycles of assembling and the nature of plant material utilized for home grown nutraceuticals are under the guidelines of food laws, which are lacking of the explicitness needed for organic medications. This for sure may have genuine outcomes.

Poison defilement like parasitic and bacterial poisons, debasements and various different sorts of contamination of natural nutraceuticals possibly stay undetected just in light of the fact that there is a practically all out shortfall of explicit quality control.

Absence of value control not just builds the likely dangers to the customer, it might likewise bring about a complete absence of the drive to lead appropriate exploration that decides the potential advantages of nutraceuticals or guarantees their security.

Significance of Herbal Nutraceutical Regulation ^[24, 25]:

- Allows better lawful security and more unsurprising climate.
- Supports development (food, home grown and drink items).
- Prevents imbalanced rivalry from makers utilizing untruthful orleading claims.
- If certain cases can't be made, the guideline doesn't satisfy anybody to make negative cases about the item.

Nutraceutical Categories ^[26]

Dietary Supplements including botanicals:

- Vitamins, minerals, co-protein Q, carnitine
- Gingseng, Ginkgo Biloba, Saint John's Wort, Saw Palmetto

Functional Foods ^[27]

A food item that is essential for regular eating regimen yet has valuable impacts that go past the conventional dietary impacts.

Examples

- Yogurts - Probiotics for digestive wellbeing.
- Foods/oats/snacks enhanced with dissolvable strands, nutrients and minerals.
- Omega-3 milk in anticipation of coronary illness

Medicinal Foods ^[28]:

- Health bars with added prescriptions.
- Transgenic cows and lacto ferrin for insusceptible improvement
- Transgenic plants for oral immunization against irresistible sicknesses.

Nutraceuticals ingredients with their therapeutic application ^[29, 30]

Table 2

Nutraceutical ingredients	Therapeutic applications
Probiotics, Prebiotics Vitamins, Antioxidants Soya based fixings Minerals Nutritional lipids and oil Fibers and carbs Dairy base ingredients	Bone and Joint Health Cancer Risk Reduction Cardiovascular Health Maternal and Infant Health Immune framework Energy and Eye Health Skin Health, Respiratory Health Weight Management Cognitive and Mental capacity Cholesterol Reduction

Area covered by nutraceutical products ^[31]:

All restorative regions like enemy of joint, pain relievers, cold and hack, dozing problems, assimilation and

anticipation of specific tumors, osteoporosis, pulse, cholesterol, sadness and diabetes have been covered by nutraceuticals.

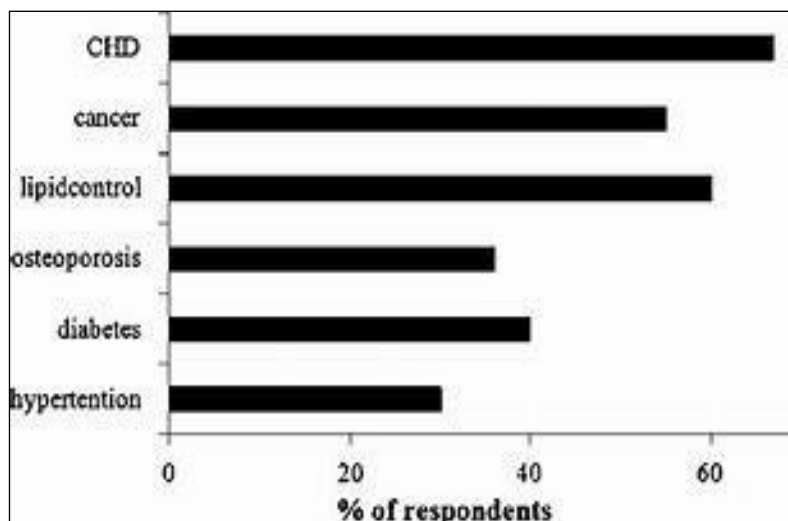


Fig 1: Percentage area covered by nutraceutical products

Research and Development ^[32]

The best logical need in nutraceuticals relates to normalization of mixtures and additionally items, to painstakingly create and execute clinical investigations/preliminaries to give the premise to wellbeing claims for nutraceuticals that sway shoppers just as organizations making vital speculations.

Rapid propels in logical information supporting the essential job of diet in wellbeing and illness anticipation.

- Skyrocketing medical services costs.
- An maturing populace.
- The changing administrative climate.

Current Status ^[33]

Nutraceutical food or food parts that assistance in treatment and counteraction of sicknesses are produced using home grown/organic natural substance. This is quickly developing industry (7-12 % each year) with more than a large number of individuals on the planet utilizing these regular items. The worldwide nutraceutical market to reach \$ 450 billion by 2015. As indicated by ongoing examination from Euro screen, worldwide deals of wellbeing and wellbeing items are on target to arrive at a record of about \$1 trillion by 2017, filled by utilitarian/strengthened items intended to offer explicit medical advantages.

Nutraceuticals with their therapeutic benefit ^[34, 35]

Table 3

Name of nutraceutical	Therapeutic benefits
Natural Lycopene	Reducing risk of prostate and cervical cancers. Supporting cardiovascular health.
Natural Purified Lutein Esters	Dietary supplement Functional foods Antioxidants.
Garlic	Cholesterol lowering Cardiac diseases
Green Tea	Diabetic support
Gymnema, Momordica	Cancer prevention Weight management
Glucosamine	Lowering cholesterol
Ginkgo Biloba	Diabetic control
Digestive Enzymes	Arthritis treatment
Ginseng	Allergy relief
Phycocyanin	Digestive support
	Immunomodulator
	Powder Antioxidant

Market trends of nutraceuticals ^[36]

The nutraceutical business' three principle portions incorporate utilitarian food sources, dietary enhancements, and home grown/regular items. Nourishment Business Journal (NBJ) distinguished a \$80 billion nutraceuticals market in 1995 by thinking about regular and natural food varieties (\$6.2 billion), practical food sources (\$13.4 billion), certain lesser-detestable food varieties with diminished or no undesirable fixings (\$23 billion), dietary enhancements (\$8.9 billion), and chose market standard food sources (\$28.3 billion). NBJ has started following nutraceuticals industry development. Beginning around 1995, the business, as characterized by NBJ, has developed by a normal of 7.1 percent each year. In 1997, industry deals added up to \$91.7 billion (NBJ 1998). The most quickly developing fragments of the business were dietary enhancements (19.5 percent each year) and regular/natural items (11.6 percent per year). As indicated by BCC Research - The worldwide nutraceuticals market developed to \$46.7 billion out of 2002, at an AAGR of almost 7%. In 2007 nutraceuticals deal was projected to reach \$74.7 billion at an AAGR of 9.9%. This expects a world financial recuperation in 2003 and a finish to value rivalry.

The future prospects of nutraceutical industry ^[37]

The world is turning out to be more modern and intriguing. Food varieties are turning out to be more alluring, engaging and sustained to satisfy the expanding need of sound nourishment. With the innovation and late advances in Living Modified Organisms (LMOs) and Genetically Modified Foods (GMFs), nourishment for all plan later on will be achieved or rather hunger would before long be history yet new difficulties might follow. With the flying in of tablets as supplements to furnish the body with complete Recommended Dietary Allowance (RDA) including fiber to guarantee digestive or inside discharging, the possibilities of nutraceuticals are boundless. The objective of food and nourishment social orders for a world free of appetite in what's to come is conceivable with the possibilities of nutraceuticals. At the center of the worth added market execution is the expanding responsiveness with respect to buyers regarding how nutraceuticals.

Some commercially marketed nutraceuticals ^[38-40]

Table 4

Product	Group	Content	Company
Calcicrol D-3®	Calcium supplement	Calcium and vitamins	Cadilla healthcare limited, India
Coral calcium	Calcium supplement	Calcium and trace minerals	Nature's answer, Hauppauge, NY, USA
Wellife®	Amino acid supplement	Granulated-L-glutamine	Daesang America Inc., Hackensack, NJ, USA
Proteinex®	Protein supplement	Predigested proteins, vitamins,	Pfizer ltd., Mumbai, India D
Daytime restore & nighttime repose	Restful sleep	Ginseng, Ginkgo biloba,	Xigo health
CogniSure	Amino acid supplement	Proline-rich polypeptide complex	Metagenics Inc
Omega woman	Immune supplement	Antioxidants, vitamins and phytochemicals	Wassen, Surrey, U.K.
PNerplus™	Neuropathic pain supplement	Vitamin and other natural supplement	NeuroHelp, San Antonio, Texas, USA
GRD Proteins,	Nutritional supplement	vitamins, minerals and carbohydrates	ZyduScadilla Ltd. Ahmedabad, India
Biovinca™	Neurotonic	Vinpocetine	Cyvox nutrition, Irvine, CA, USA

Conclusion

The nutraceutical business is developing at a rate far surpassing extension in the food and drug ventures. In the upcoming business sector, the best nutraceutical players are probably going to be those organizations where utilitarian item are only a piece of an expansive line of products fulfilling both regular and wellbeing esteem point. Future interest of nutraceutical relies upon purchaser impression of the connection among diet and sickness. In the current situation of self-medicine nutraceuticals assume significant part in restorative turn of events. However, their prosperity relies upon keeping up with on their quality, immaculateness, security and adequacy.

Reference

- Shinde N, Bangar B, Deshmukh S, Kumbhar P. Nutraceuticals: A Review on current status. *Research journal of pharmacy and technology*,2014;7(1):110-3.
- Crandell KA, Duren ST. Nutraceuticals: what are they and do they work. *J Biotechnol*,2007;34(3):29-36.
- Kalra EK. Nutraceutical-definition and introduction. *Aaps Pharmsci*,2003;5(3):27-8.
- Nwosu OK, Ubaaji KI. Nutraceuticals: History, classification and market demand. In *Functional foods and nutraceuticals 2020* (pp. 13-22). Springer, Cham.
- Kumari M, Jain S, Singh J. Nutraceutical—medicine of future. *Journal of Global Biosciences*,2015;4(7):2790-4.
- Egbuna C, Dable-Tupas G. Functional foods and nutraceuticals. Springer Nature Switzerland AG,2020:1:1-632.
- Chauhan B, Kumar G, Kalam N, Ansari SH. Current concepts and prospects of herbal nutraceutical: A review. *Journal of advanced pharmaceutical technology & research*,2013;4(1):4.
- Simpson KL. Chemical changes in natural food pigments. In *Chemical changes in food during processing* Springer, Dordrecht, 1985, 409-441.
- Shen CY, Jiang JG, Yang L, Wang DW, Zhu W. Anti-ageing active ingredients from herbs and nutraceuticals used in traditional Chinese medicine: pharmacological mechanisms and implications for drug discovery. *British Journal of Pharmacology*,2017;174(11):1395-425.
- Lupton JR, Brooks JA, Butte NF, Caballero B, Flatt JP, Fried SK. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. National Academy Press: Washington, DC, USA,2002:5:589-768.
- Almatroodi SA, Alsahli MA, Almatroudi A, Khan AA, Rahmani AH. Peppermint (*Mentha × piperita*): Role in Management of Diseases through Modulating Various Biological Activities. *Pharmacognosy Journal*, 2021, 13(3).
- Dillard CJ, German JB. Phytochemicals: nutraceuticals and human health. *Journal of the Science of Food and Agriculture*,2000;80(12):1744-56.
- Dhawan S, Kaur J. Microbial mannanases: an overview of production and applications. *Critical reviews in biotechnology*,2007;27(4):197-216.
- Markowiak P, Ślizewska K. Effects of probiotics, prebiotics, and synbiotics on human health. *Nutrients*,2017;9(9):1021.
- Pulz O, Gross W. Valuable products from biotechnology of microalgae. *Applied microbiology and biotechnology*,2004;65(6):635-48.
- Craig WJ. Nutrition concerns and health effects of vegetarian diets. *Nutrition in Clinical Practice*,2010;25(6):613-20.
- Singh J, Sinha S. Classification, regulatory acts and applications of nutraceuticals for health. *International Journal of Pharma and Bio Sciences*,2012;2(1):177-87.
- Gulati OP, Ottaway PB. Legislation relating to nutraceuticals in the European Union with a particular focus on botanical-sourced products. *Toxicology*,2006;3;221(1):75-87.
- Demoz MS, Gachoki KP, Mungai KJ, Negusse BG. Ethnobotanical survey and preliminary phytochemical studies of plants traditionally used for diabetes in Eritrea. *European Journal of Medicinal Plants*,2015;4:1-1.
- Orekhov AN, Panossian AG. Trihydroxyoctadecadienoic acids exhibit antiatherosclerotic and antiatherogenic activity. *Phytomedicine*,1994;1(2):123-6.
- Williams JE. Review of antiviral and immunomodulating properties of plants of the Peruvian rainforest with a particular emphasis on *Una de Gato* and *Sangre de Grado*. *Alternative Medicine Review*,2001;6(6):567-80.
- Cullen BR. Viruses and microRNAs: RISCy interactions with serious consequences. *Genes & development*,2011;25(18):1881-94.
- Bhatnagar D, Yu J, Ehrlich KC. Toxins of filamentous fungi. *Chemical immunology*,2002;81:167-206.
- Raban O. The fallacy of legal certainty: Why vague legal standards may be better for capitalism and liberalism. *BU Pub. Int. LJ*,2009;19:175.
- Stone M, Laughlin P. How interactive marketing is changing in financial services. *Journal of Research in Interactive Marketing*, 2016.
- Mahady GB, Fong HH, Farnsworth NR. Botanical dietary supplements. CRC Press, 2001.

27. Roberfroid MB. Global view on functional foods: European perspectives. *British Journal of Nutrition*,2002;88(S2):S133-8.
28. Choudhry NK, Shrank WH, Levin RL, Lee JL, Jan SA, Brookhart MA *et al.* Measuring concurrent adherence to multiple related medications. *The American journal of managed care*,2009;15(7):457.
29. Shinde N, Bangar B, Deshmukh S, Kumbhar P. Nutraceuticals: A Review on current status. *Research journal of pharmacy and technology*,2014;7(1):110-3.
30. Bhowmik D, Chiranjib K, Kumar S. A potential medicinal importance of zinc in human health and chronic. *Int J Pharm*,2010;1(1):05-11.
31. Ahmad MF, Ahmad FA, Azad ZA, Alam MS, Ashraf SA. Nutraceutical is the need of hour. *World J. Pharm. Pharm. Sci.*2013;2:2516-25.
32. Coory MD. Ageing and healthcare costs in Australia: a case of policy-based evidence?. *Medical Journal of Australia*,2004;180(11):581-3.
33. Kidder RM, McLeod B. *Moral courage*. New York: W. Morrow; 2005.
34. Lobo V, Patil A, Phatak A, Chandra N. Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacognosy reviews*,2010;4(8):118.
35. Ligibel JA, Basen-Engquist K, Bea JW. Weight management and physical activity for breast cancer prevention and control. *American Society of Clinical Oncology Educational Book*,2019;17;(39):e22-33.
36. Penm J, Fisher BS. Economic overview: prospects for world economic recovery in 2003. *Australian Commodities: Forecasts and Issues*,2003;10(1):5-19.
37. Ferguson RF. Become more sophisticated about diversity. *The Learning Professional*,2007;1;28(3):33.
38. Lehti M, Donelan E, Abplanalp W, Al-Massadi O, Habegger KM, Weber J *et al.* *Circulation*,2013;26:128(22):2364-71.
39. Dutt S, Advani SH, Dhabhar BN, Dattatreya PS, Patil S, Chatterjee S *et al.* Experience of ALK mutation testing in 3351 Indian patients of NSCLC. *Annals of Oncology*,2014;1:25:iv66.
40. Bahadoran Z, Tohidi M, Nazeri P, Mehran M, Azizi F, Mirmiran P. Effect of broccoli sprouts on insulin resistance in type 2 diabetic patients: *International journal of food sciences and nutrition*,2012;1:63(7):767-71.
41. Sarukh VS, NAGOBA SN, Hindole SS, Kaudewar KD, More DR. Formulation and evaluation of herbal gel containing allium cepa extract. *Journal of Drug Delivery and Therapeutics*. 2019 Aug 15;9(4-s):492-6.