



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IX **Month of publication:** September 2026

DOI: <https://doi.org/10.22214/ijraset.2026.84921>

www.ijraset.com

Call: ☎ 08813907089

E-mail ID: ijraset@gmail.com

A Review on Nutraceutical

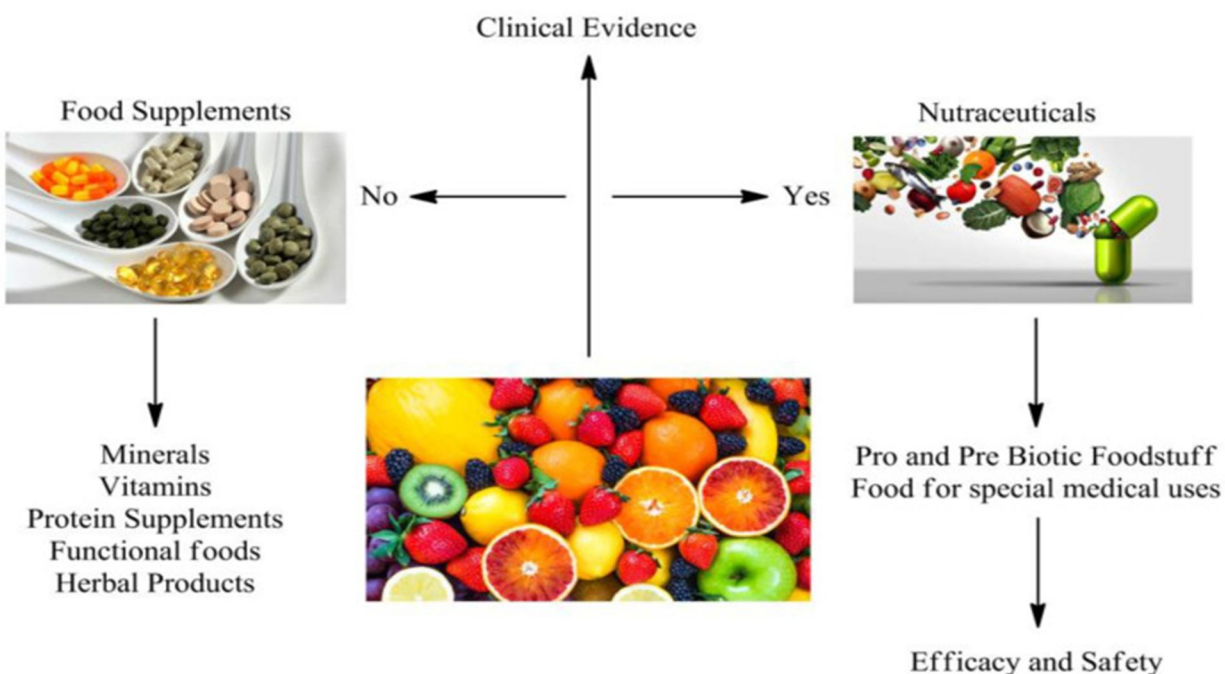
Akhilesh Kumar¹, Mr. Pramod Mishra², Mr. Sujeet Pratap Singh³, Dr. Tarkeshwar P. Shukla⁴
S.C.P.M College of Pharmacy, Lucknow Road Haripur Gonda

Abstract: Nutraceuticals bridge the gap between nutrition and therapeutics, serving as bio-active food components that aid in disease prevention and health management. The boundary between nutrition and medicine has blurred with the rise of nutraceuticals—a term coined from "nutrition" and "pharmaceutical". This review examines the growing significance of nutraceuticals in modern pharmacy practice, transitioning from basic health promotion to targeted disease prevention and adjuvant therapy. Derived from natural, food-based bioactive components, these products include dietary supplements, functional foods, and botanical extracts. Clinical data increasingly supports their efficacy in managing chronic conditions such as cardiovascular disease, diabetes, obesity, and cancer by mitigating oxidative stress and inflammation. However, the field faces significant challenges, including poor bioavailability, a lack of strict regulatory standardization (e.g., FDA vs. DSHEA frameworks), and potential drug-nutrient interactions.

Keywords: Nutraceutical, Classification of nutraceuticals

I. INTRODUCTION

The term 'nutraceutical' was coined in 1989 by the Foundation for Innovation in Medicine (New York, US), to provide a name for this rapidly growing area of biomedical research. A nutraceutical was defined as any substance that may be considered a food or part of a food and provides medical or health benefits including the prevention and treatment of disease. Nutraceuticals may range from isolated nutrients, dietary supplements and diets to genetically engineered "designer" foods, herbal products and processed products such as cereals, soups and beverages. Doubtlessly, many of these products possess pertinent physiological functions and valuable biological activities. Therefore, public demand forced the appearance of products containing concentrated nutrient-ingredients. Since for the last centuries pharmaceuticals were the tools that brought healing for sick people the form of these concentrated nutrients became similar, and later on identical to pharmaceutical dosage forms. And by now we arrived at the point where the majority of the consumers cannot differentiate between OTC pharmaceuticals and dietary supplements, phototherapeutic products (herbal medicines), natural health products, or nutraceuticals



- 1) In most of the cases if people don't feel that it is too necessary to visit a doctor, Often the visit will be postponed.
- 2) The reason of it also could be that to see a doctor is a time consuming and uncomfortable process.
- 3) So, the idea behind inventing the "Nutraceuticals" was to make sure people receives health protective and curative Product That they can purchase without seeing a doctor.
- 4) These Product are mostly used to treat or prevent nutritional deficiency or to reduce risk of non-deficiency disease.[1]
- 5) The term Nutraceuticals was coined By- "Stephan Defelice" and the term nutraceutical is a combination of two word- Nutrients and Pharmaceuticals.
- 6) A nutraceutical is any substance that is a food or a part of food and provides medicals and health benefits including the Treatment or Prevention Of any disease or nutritional deficiency.
- 7) Some examples- Fish Oils, Prebiotics, Probiotics etc.

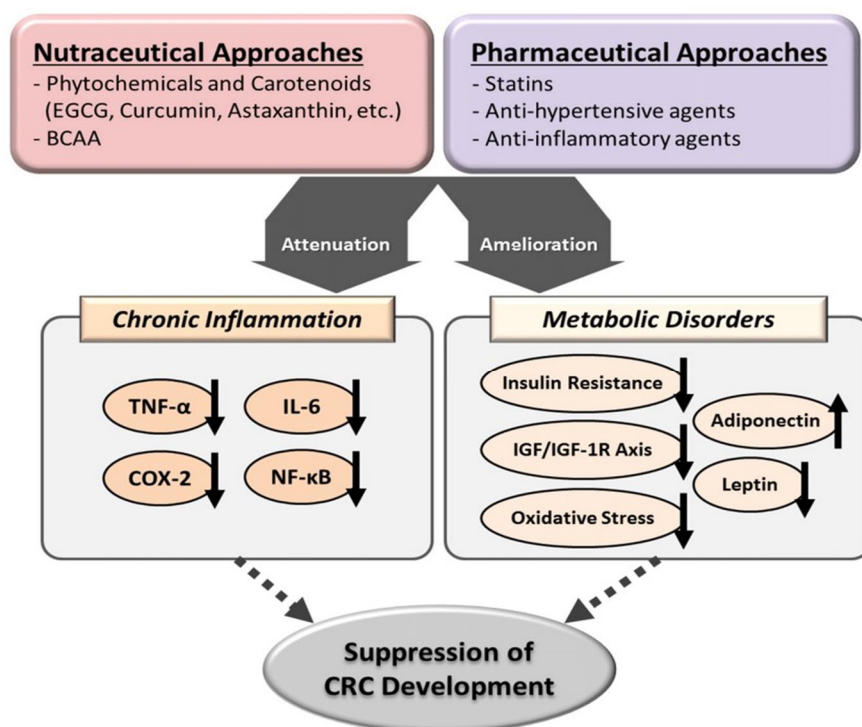
II. HISTORY OF NUTRACEUTICALS

Throughout history, civilized society Have devoted a Deep interest in integrity of Food Supply. Long before the development of the distinct scientific discipline of Nutrition, Philosophers and latter Physicians paid close attention to the role of daily diet in Individual and public health, From the time of Hippocrates (460-377 BC).

- 1) Hippocrates clearly recognized the essential relationship between food and Health and emphasized that difference of disease depends on nutriments.
- 2) Pliny The Elder (23-79 AD) Found wide spread adulteration throughout food and drug supply outline in natural history "So many poisons are employed to force wine to suit our taste and we are surprised that it is not wholesome".
- 3) Galen (131-201 AD), A Physician, reflected confidence in the knowledge and ability of physician to establish sound diets that would advance public health.
- 4) Casimir Funk Discovered, in the shell of rice grain A Nitrogen containing amine-base (Amine); since he thought that's this substance is "life-essential" for the human being, He defined the idiom

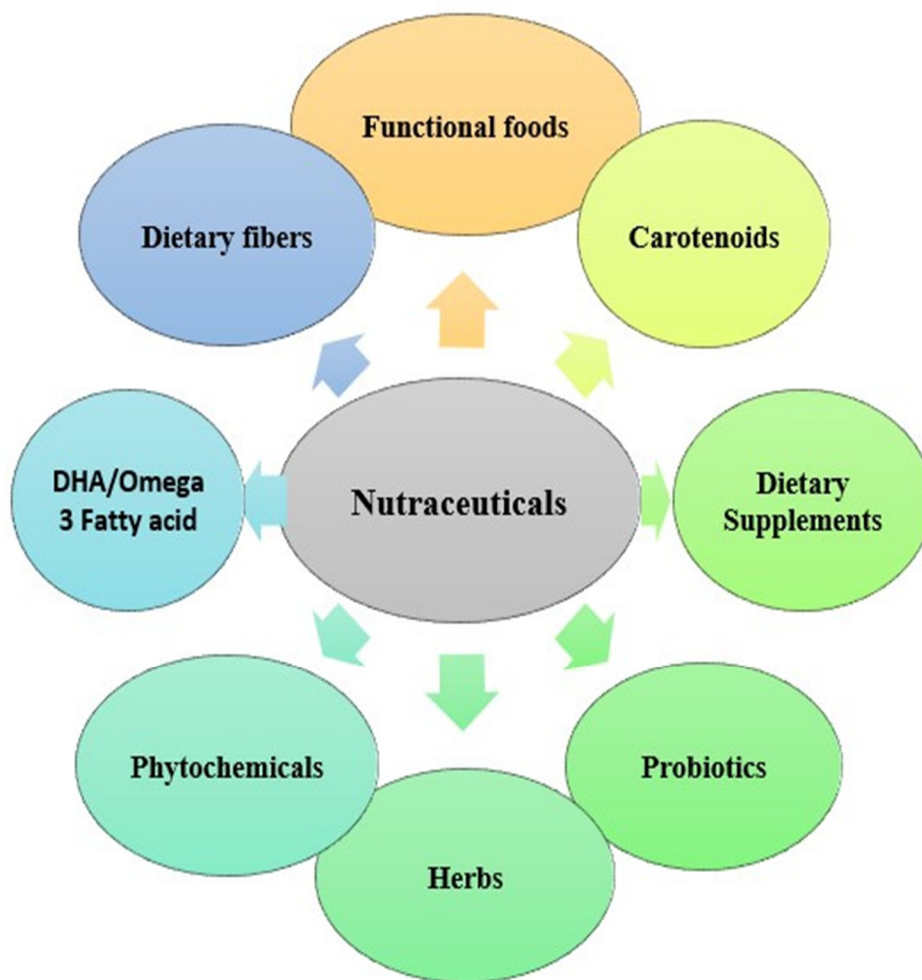
"Vitamin From Vita= life" and amine". In present times Dr. Muhammed Majeed is known to be the father of Indian Nutraceutical Industry.

III. MECHANISM OF NUTRACEUTICALS



- TNF-ALPHA- Tumor Necrosis Factor(alpha), is an inflammatory cytokine produced by macrophages/monocytes during acute inflammation.
- IL-6 is a multifunctional cytokine that plays a central role in host defence due to its wide range of immune and hematopoietic activities.
- Cox-2 is cyclooxygenase-2 involved in inflammation
- NF- κ B is a family of transcription factor protein complexes. controls DNA transcription and cytokines production.

IV. CATEGORIES OF NUTRACEUTICALS



V. CLASSIFICATION OF NUTRACEUTICALS

- 1) Traditional Nutraceuticals
 - Chemical Constituent
 - Probiotic Microorganism
 - Nutraceutical enzyme
- 2) Non-Traditional Nutraceuticals
 - Fortified Nutraceuticals
 - Recombinant nutraceuticals

A. Traditional Nutraceuticals

They are simply natural with no changes to the food. food contains several natural components that delivers benefits of more than basic nutrition, e.g. lycopene in tomatoes, Omega 3 fatty acid in salmon or saponins.

1) Chemical Constituents

- Nutrients –such as vitamins, minerals, amino acids and fatty acids with established nutritional function.
- Herbals- such as peppermint (*Mentha -piperita*) contains menthol as an active component and cures cold and flu, Lavender contain tannins, helpful incurring depression, hypertension, stress cold, cough and asthma.
- Phytochemicals- such as -Legumes (chickpeas and soybeans), grains, palm oil contain non-carotenoids, which remove cholesterol and are anticarcinogenic.

2) Probiotic Microorganisms

‘Probiotics’ mean ‘for life’ and are defined as live microorganisms, which when consumed in adequate amounts, confer a health effect on the host. They are friendly bacteria that promote healthy digestion and absorption of some nutrients. E.g. *Lactobacillus acidophilus* by Milk.

3) Nutraceutical Enzymes

These enzymes are derived from microbial, plant and animal sources. Medical conditions such as hypoglycemia, blood sugar disorders, digestive problems and obesity, symptoms are eliminated by enzyme supplements to their diet. E.g. cellulase and lactase by microbial enzyme, bromelain (pineapple) plant enzymes

B. Non-traditional nutraceuticals

They are artificial foods prepared with the help of biotechnology. Food samples contain bioactive components which are engineered to produce products for human- wellness. They are arranged into-

- Fortified Nutraceuticals-It constitutes fortified food from agricultural breeding or added nutrients or ingredients. E.g. orange juice fortified with calcium, cereals with added vitamins or minerals and flour with added folic acid.
- Recombinant nutraceuticals- Energy-providing foods, such as bread, alcohol, cheese, vinegar, and others are produced with the help of **biotechnology**. E.g. resveratrol (recombinant microorganism), Soybean ferritin gene (recombinant plant).

1) Scope of nutraceuticals

- GI Disease
- Arthritis
- Antidiabetic
- Oxidative Stress
- Allergic Condition
- CVS Disease
- Inflammation
- Cancer

2) Benefits of Nutraceuticals

- Increase the health value of our diet.
- Helps to live longer.
- Help to avoid particular medical condition.
- Delay aging
- Provide dietary supplement naturally
- Reduced side effect and desirable outcomes

3) Physiological Benefits of nutraceuticals

- Cardiovascular agent
- Antidiabetic agent
- Anticancer agent

- Immune booster
- Chronic inflammatory disorder
- Degenerative disease

4) Disadvantages of Nutraceuticals

- They are not subjected to testing regulation same as pharmaceuticals.
- They are not regulated by authority boards like FDA.
- The bioavailability of nutraceuticals is low.
- Unregulated product are created with only meeting the profit margin.

List of Some Marketed Nutraceutical Product

Brand Name	Components	Functions
Betatene	carotenoids	Immune Function
xangold	Lutein ester	Eyes health
Lipoec	Alpha-lipoic acid	Potent antioxidant
Generol	Phytosterol	CHD reduction
Premium probiotics	Probiotics	Intestinal Disorder
Soylife	Soyabean Phytoestrogen	Bone Halth

VI. COMMERCIAL NUTRACEUTICAL

Commercial nutraceuticals are also classified into these two groups.

1) Dietary supplements

- They are concentrated sources of nutrients or other substances with a nutritional or physiological effect, alone or in combination.
- Dietary supplements contain all products that can be purchased by the consumer without a prescription. Many potential benefits have been attributed to antioxidants used in the form of dietary intake or supplementation. Antioxidants, in general, may be useful in the prevention of cancer and cerebrovascular disease. Dietary supplements are not classified as drugs. The main difference is that They do not have approved therapeutic claims unlike in the case of drugs. Moreover, dietary supplements could either contain vitamins, minerals, herbals, or amino acids, all aimed to add to or supplement the diet of an individual. They are not intended to be taken alone as a substitute for any food or medicine.

2) Functional food

As defined by the United States of America Institute of medicine's Food and Nutrition Board Functional Food is "any food or food ingredient that may offer health benefit beyond the traditional nutrients it contains" The functional food concept is –

"Food products to be taken as part of the usual diet to have helpful effects that go beyond basic nutritional function". Functional foods contain physiologically active components obtained either from plants or animal sources.eg. lutein, saponins, flavanones etc.

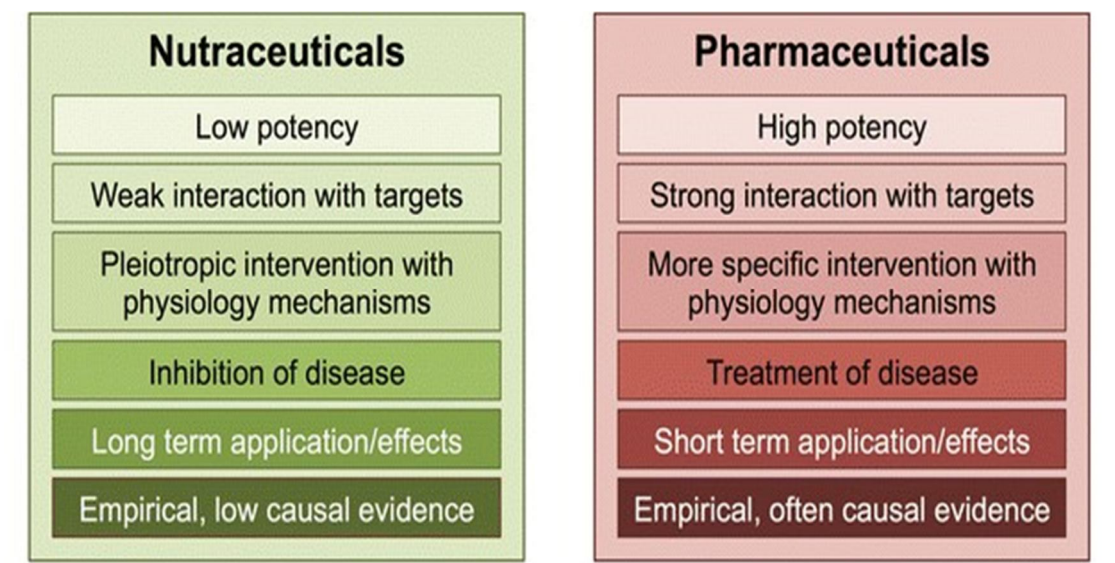
Interaction Between Nutraceuticals /Nutrients andTherapeutic Drug

Interactions between foods, dietary supplements and drugs present complex and challenging problems. They may be caused by either alteration on absorption, distribution, biotransformation and excretion.

Eg. Special mention is made on interactions with grapefruit juice, and mono amine oxidase (MAO) drug inhibitors, that are used to treat depression.

Ginseng reduces the blood levels of warfarin and alcohol as well as induced mania if taken concomitantly with phenelzine, a non-selective and irreversible monoamine oxidase inhibitor used as an antidepressant and anxiolytic agent.

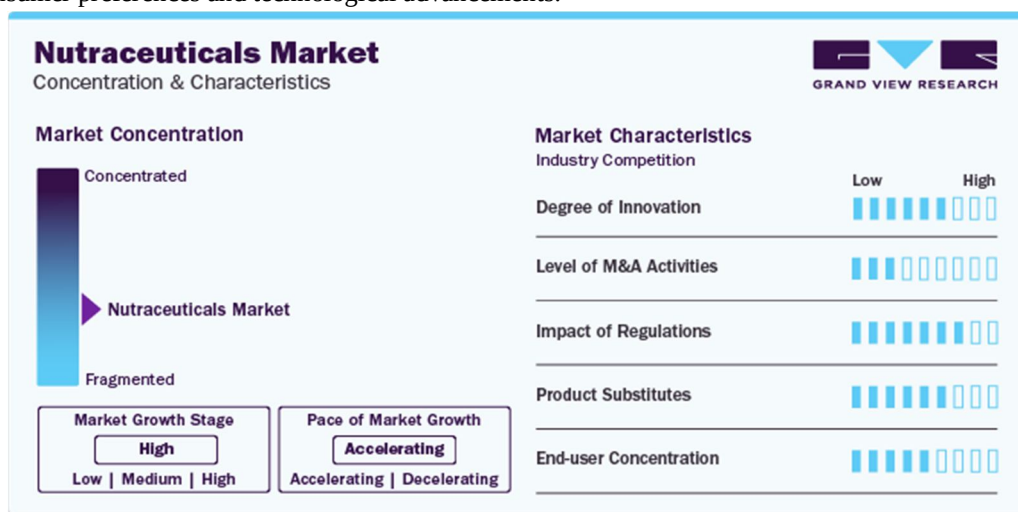
Difference Between Nutraceuticals and Pharmaceuticals



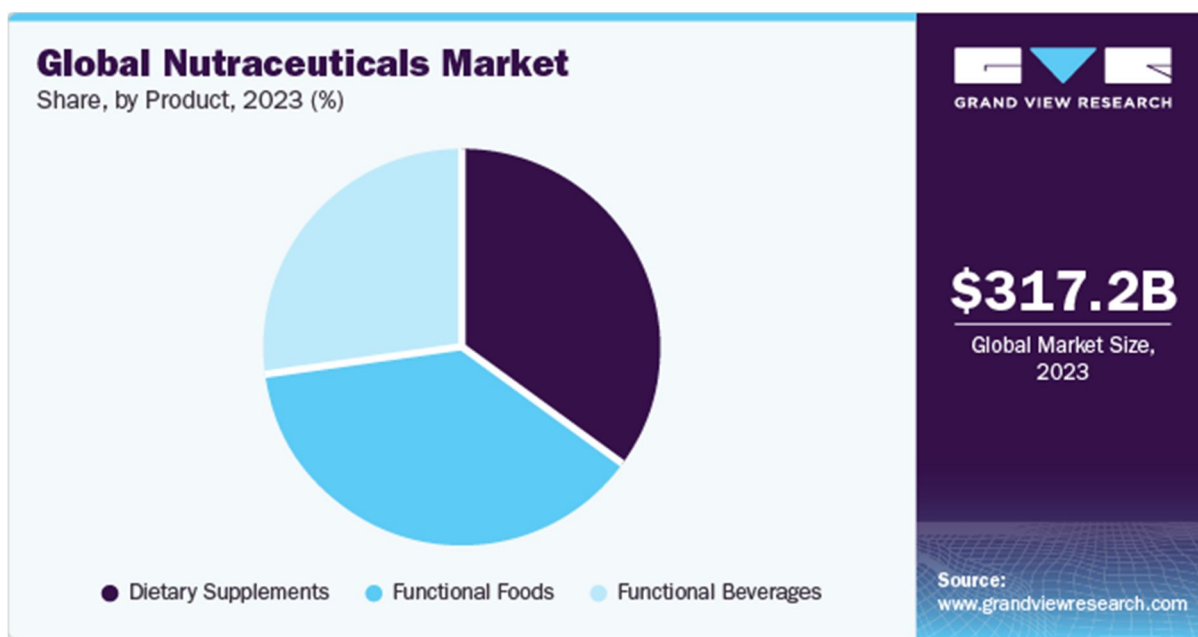
VII. NUTRACEUTICALS MARKET

The Nutraceuticals Market size is estimated at USD 488.41 billion in 2024, and is expected to reach USD 626.02 billion by 2029.

- 1) Increased Demand From Healthy & Functional Foods- Rising consumer interest in functional food results from health benefits, performance, and perceived wellness. Due to the ease of incorporating nutraceutical ingredients, the demand for functional end-products such as dairy products, bakery and confectionery, snacks, oils, and baby food is rising.
- 2) Market Concentration & Characteristics- The nutraceuticals industry has experienced a high degree of innovation attributed to evolving consumer preferences and technological advancements.



Product Insights- Technological upgradation, coupled with progression in product development, is projected to drive the functional foods industry over the coming years.



VIII. CONCLUSION

- 1) Nutraceuticals could be useful to live a healthier and glorious lifestyle.
- 2) But the standard should be Maintained same as the Pharmaceuticals.
- 3) Due to the lack of the quality and safety standards Nutraceutical market is not having equal Growth as pharmaceuticals.
- 4) The nutraceuticals help in maintaining the health and in improving the immune system.
- 5) More recognition with More productivity and standards should be Gained by the nutraceutical Market in the times will be achieved.
- 6) Nutraceuticals have proven health benefits and disease prevention capabilities, which should be taken under their acceptable recommended intake.
- 7) Nutraceuticals play an important role in therapeutic development in the current self-medication landscape, but their success depends on maintaining their quality, purity, safety, efficacy.
- 8) Nutraceuticals represent a special group of healthcare products: not pharmaceuticals and not really dietary supplements but somewhere in between. Even if nutraceutical products are not approved by the health authorities, their effects are similar to pharmaceuticals. The similarity and the reliability depend on the manufacturer. Consumers and patients take nutraceuticals as drugs. Therefore, healthcare professionals, medical doctors, and pharmacists should also take into account during counseling that nutraceuticals are not approved pharmaceuticals and effectiveness and adverse effects may be different from pharmaceuticals having the same ingredients. The deviations should be reported to the competent persons in order to avoid unnecessary hazards.

IX. DISCUSSION

- 1) Nutraceuticals may be used to improve health, delay the aging process, prevent chronic diseases, increase life expectancy, or support the structure or function of the body.

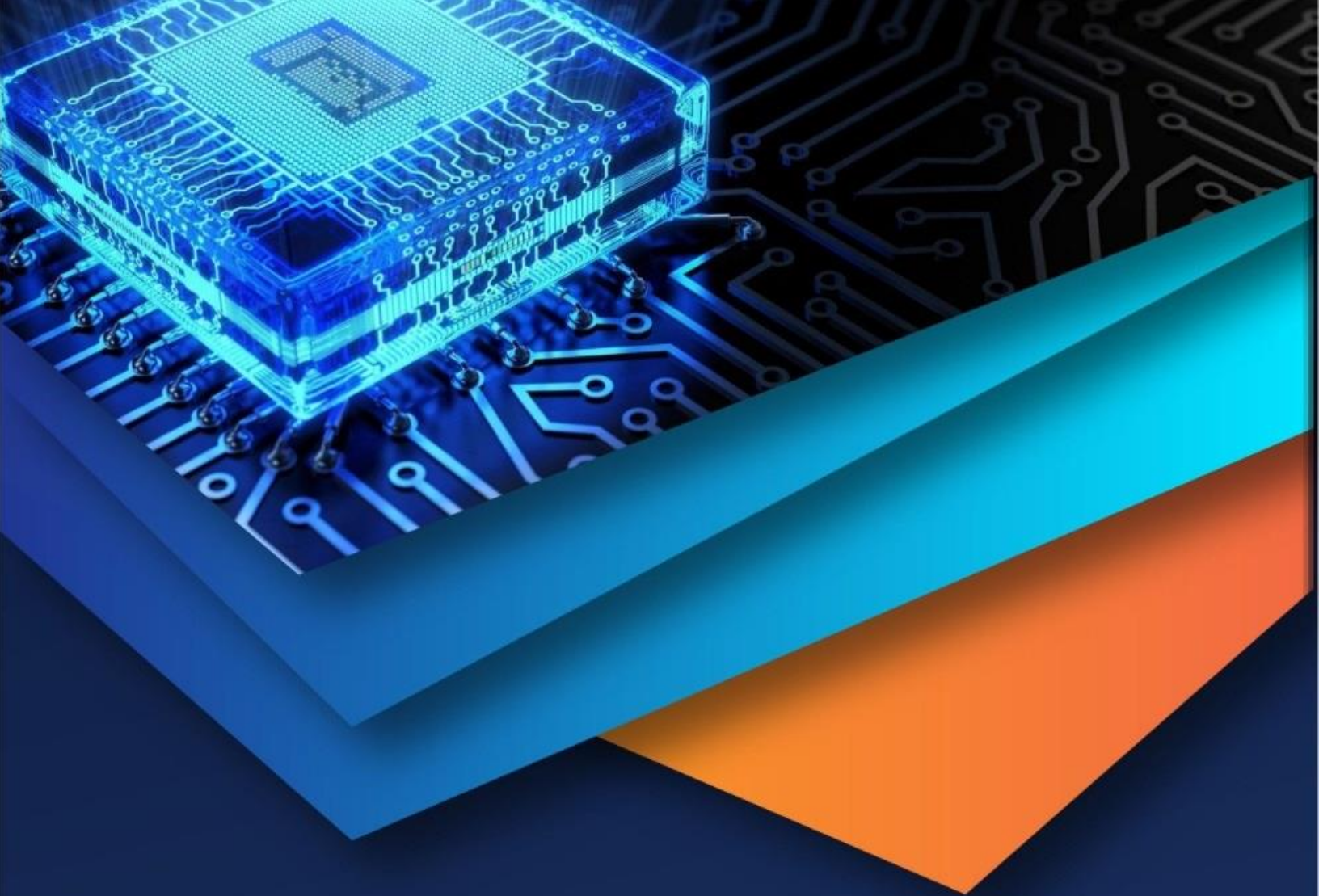
- 2) Some popular nutraceuticals include ginseng, green tea, glucosamine, omega-3, lutein, folic acid, and cod liver oil. Majority of the nutraceuticals possess multiple therapeutic properties.
- 3) Nowadays, nutraceuticals have received high interests due to their potential nutritional and safety profile, other than therapeutic capability. Pharmaceutical and nutritional companies are aware of the changing trends which are due to the advantages of these compounds. Most of the nutraceuticals possess multiple therapeutic benefits.
- 4) The current knowledge of the beneficial effects of nutraceuticals will undoubtedly have an impact on nutritional therapy. At present, nutraceutical represent the fastest growing segment of today's food industry. The market is estimated at 30 billion US \$ growing at 5% per annum. The correct balance is struck between the exploitation of lucrative business (irresponsible market entrants) and adequate consumer protection (Hardy 2000). Although it may be many years before the new designer foods will be stocked on supermarket shelves, the ongoing program will lead to a new generation of foods, which will certainly cause the interface between food and drug to become increasingly permeable. Thus, in the future we will see the emergency of nutraceutical soups, nutraceutical processed meat, bread and sausage. And many of these foods might be genetically produced.

REFERENCES

- [1] Lockwood B. nutraceuticals. 2nd ed London Grayslake (USA): Pharmaceutical press; 2007
- [2] Lockwood B. Nutraceuticals. 2nd ed London Grayslake (USA): Pharmaceutical Press; 2007
- [3] Kalra EK. Nutraceutical – Definition and introduction. AAPS
- [4] Pharm Sci. 2003;5:E25. [PMC free article] [PubMed] [Google Scholar]
- [5] Bickford PC, Tan J, Shytle RD, Sanberg CD, El-Badri N, Sanberg
- [6] PR. Nutraceuticals synergistically promote proliferation of human stem cells. Stem Cells Dev. 2006; 15: 23-118.
- [7] Devi VK, Rehman F. Nutraceutical antioxidants-An overview, Indian journal of pharmaceutical education. 2002; 36(1):3-8.
- [8] Bell SJ, Goodrick GK. A Functional Food Product for the Management of Weight Critical Reviews in Food Science and Nutrition. 2002; 42: 163-178.
- [9] Brouns F. Soya isoflavones: a new and promising ingredient for the health foods sector. Food Research International. 2002; 35: 187-193.
- [10] Sirtori CR, Galli C. Fatty acids and the Omeg-
- [11] 3. Biomedicine and Pharmacotherapy. 2002; 56: 397-406.
- [12] <https://www.grandviewresearch.com/industryanalysis/nutraceuticals-market>
- [13] https://www.researchgate.net/figure/Comparison-of-nutraceuticals-and-pharmaceuticals-Nutraceuticals-can-be-consumed-via_fig3_312181980
- [14] <https://www.grandviewresearch.com/industryanalysis/nutraceuticals-market>
- [15] <https://www.slideshare.net/vishwanth555/nutraceuticals16936739>
- [16] Lopes, V. and Alexandre L.A., An overview of blockchain integration with robotics and artificial intelligence. arXiv preprint arXiv:1810.00329, 2018. [Google Scholar]
- [17] Kawal, F., A Tour to the World of Artificial Intelligence. CYBERNOMICS, 2020. 2(5): p. 33-35. [Google Scholar]
- [18] SIRI. [cited 2022 20 May]; Available from: <https://www.techtarget.com/searchmobilecomputing/definition/Siri>.
- [19] What Is Alexa? [cited 2022 20 May]; Available from: <https://itchronicles.com/artificial-intelligence/is-alexa-an-ai/#:~:text=What%20Is%20Alexa%3F,Echo%20and%20Dot%20smart%20speakers>.
- [20] How Google's Self-Driving Car Will Change Everything. [cited 2022 20 May]; Available from: <https://www.eescorporation.com/do-self-driving-cars-use-ai/>.
- [21] Das, S., et al., Applications of Nutraceutical in machine learning: review and prospect. International Journal of Computer Applications, 2015. 115(9). [Google Scholar]
- [22] Heudin, J.-C. Artificial life and evolutionary computing in machine perception. in Proceedings of Conference on Computer Architectures for Machine Perception. 1995. IEEE. [Google Scholar]
- [23] State Of AI And Machine Learning In 2019.; Available from: <https://www.forbes.com/sites/louiscolombus/2019/09/08/state-of-ai-and-machine-learning-in-2019/?sh=133dd64c1a8d>.
- [24] Mulholland, M., et al., A comparison of classification in artificial intelligence, induction versus a self-organising neural networks. Chemometrics and Intelligent Laboratory Systems, 1995. 30(1): p. 117-128. [Google Scholar]
- [25] Shakya, S., Analysis of Nutraceutical based image classification techniques. Journal of Innovative Image Processing (JIIP), 2020. 2(01): p. 44-54. [Google Scholar]
- [26] Arend Hintze. Understanding the four types of AI. [cited 2022. 13 June]; Available from: <https://theconversation.com/understanding-the-four-types-of-ai-from-reactive-robots-to-self-aware-beings-67616>.
- [27] Ganapathy, K., Abdul S.S., and Nursetyo A.A., Nutraceutical in neurosciences: A clinician's perspective. Neurology India, 2018. 66(4): p. 934. [DOI] [PubMed] [Google Scholar]
- [28] Manikiran, S. and Prasanthi N., Artificial Intelligence: Milestones and Role in Pharma and Healthcare Sector. Pharma times, 2019. 51: p. 9-56. [Google Scholar]
- [29] Deep Mind's health team. [cited 2022 13 June]; Available from: <https://www.deepmind.com/blog/deepminds-health-team-joins-google-health>.
- [30] IBM Watson for Oncology.; Available from: https://www.ibm.com/common/ssi/cgi-bin/ssialias?appName=skmwww&htmlfid=897%2FENUS5725-W51&infotype=DD&subtype=SM&mhsr=ibmsearch_a&mhq=IBM%20WATSON%20Oncology#:~:text=IBM%20Watson%20for%20Oncology%2C%20software,Center%20physicians%20and%20other%20analysts.
- [31] IBM. Medical Sieve.. [cited 2022 13 June]; Available from: https://researcher.watson.ibm.com/researcher/view_group.php?id=4384.
- [32] MOLLY, THE VIRTUAL NURSE. [cited 2022 13 June]; Available from: <http://adigaskell.org/2015/03/20/meet-molly-the-virtual-nurse/>.
- [33] AiCure. THE RIGHT DOSE FOR THE RIGHT PATIENT. [cited 2022 13 June]; Available from: <https://aiculture.com/>.



- [34] Deep Genomics. Programming RNA Therapies Any Gene, Any Genetic Condition. [cited 2022 13 June]; Available from: <https://www.deepgenomics.com/>.
- [35] Shampo, M.A. and Kyle R.A., J. Craig Venter--The Human Genome Project. Mayo Clinic proceedings, 2011. 86(4): p. e26-e27. [DOI] [PMC free article] [PubMed] [Google Scholar]
- [36] Atomwise. Nutraceuticalfor Drug Discovery.; Available from: <https://www.atomwise.com/>.
- [37] Open AI Ecosystem.; Available from: <https://www.scientificamerican.com/article/open-ai-ecosystem-portends-a-personal-assistant-for-everyone/>.
- [38] eInvoicing in The Netherlands.; Available from: <https://ec.europa.eu/digital-building-blocks/wikis/display/DIGITAL/eInvoicing+in+The+Netherlands>.
- [39] Fleming, N., How Nutraceuticals changing drug discovery. Nature, 2018. 557(7706): p. S55-S55. [DOI] [PubMed] [Google Scholar]
- [40] Okafo, G., Adapting drug discovery to artificial intelligence. Drug Target Rev, 2018: p. 50-52. [Google Scholar]
- [41] Ferrero, E., Dunham I., and Sanseau P., In silico prediction of novel therapeutic targets using gene–disease association data. Journal of translational medicine, 2017. 15(1): p. 1-16. [DOI] [PMC free article] [PubMed] [Google Scholar]
- [42] Katsila, T., et al. , Computational approaches in target identification and drug discovery. Computational and structural biotechnology journal, 2016. 14: p. 177-184. [DOI] [PMC free article] [PubMed] [Google Scholar]



10.22214/IJRASET



45.98



IMPACT FACTOR:
7.129



IMPACT FACTOR:
7.429



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24*7 Support on Whatsapp)