

Nutraceuticals: Past, Present, Future trend in Pharmaceuticals.

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ABSTRACT :

Nutraceutical is defined as any substance that is food or part of food and provides medical or health benefits, including the prevention and treatment of disease. Each year people are dying by administering the “safe” over the counter drugs. But the deaths due to the administration of the herbs are so rare and they are sometimes hard to find. The synthetic drugs sometimes indicated the symptoms caused by specific disease which is understood by scientific pathology, but in case of herbal medicines they usually diverts towards aiding the body’s healing process. Such yearly deaths due to the toxicity and adverse effects of drugs people are turning to herbal medicines because their believe in that the plant remedies are free from the undesirable side effects and toxicity. There are some drug like plants which shows some actions that approaches to pharmaceuticals. The quality of life in terms of income, expenditure and lifestyle has been advancing with economic development. However, it has also thrown up a major challenge in terms of ‘Lifestyle diseases’.

KEY WORDS : Nutraceuticals, Herbal medicines, nutrients, recent trends

I. INTRODUCTION

The quality of life in terms of income, expenditure and lifestyle has been advancing with economic development. However, it has also thrown up a major challenge in terms of ‘Lifestyle diseases’. The main reason of this alteration in lifestyle has been a food habit. Ingesting a fast food has been increased in day to day life which are leading to diseases related to nutritional deficiencies for this the nutraceuticals are playing vital role in monitoring such diseases. For such problems people’s interest is shifting towards nutraceuticals^{[1][2][3][4]}.

People’s concern in beneficial, nutritious, and functional products has been increasing rapidly in recent years. The reasons why some foods are on the frontline may be credited to awareness in consumption, greater importance on health, and

increased disposable income. At this point, beverages have an importance in human consumption. Beverage term includes a wide variety of compositions including fruit juice, water, tea, coffee, milk, alcohol, energy drinks, soda, or any combination of them. Besides the physicochemical effects on body, some of the beverages as coffee and tea have social effects between people.

More water content in the formulations usually leads to microbial growth which increases impurities into the food ingredients. Hence, maintenance by the way of drying is one of the chosen method for them. Powdered drink is available for soft drinks as juice, milk, coffee, some mixes^[5]. The drinks in powdered form are currently popular in terms of new flavor options. The instantaneous arrangement provides a ready-to-drink nature to these commercial and value-added products^[6]. Besides large variety of flavors and good yield of powdered drinks for consumers, drying gains storage, and transportation easiness to the beverages through condensed volume for producers.

The term nutraceutical was derived from nutrition and pharmaceutical in 1989 by Stephen Defelice, founder and chairman of foundation for innovation in medicine, an American organization which inspires medical health. According to him “a nutraceutical is a substance which might be foodstuff or a part of food that provides medical or healthiness including the avoidance and treatment of disease”^[1].

The concept of nutraceutical was observed from the survey in U.K., Germany and France and it completed that diet is rated more highly by customer than exercise or hereditary factors to realizing a good health. In the U.S. “nutraceutical” was normally used with no regulatory definition. Its significance was corrected by health ministry of Canada which describes nutraceutical as “a product isolated or purified from the foodstuff, generally sold in medicinal form isn’t related with food and

recognized to have a physiological benefit. It also provides advantage against chronic disease^[8].

Nutraceutical was devised by the combination of two words that is nutrition and pharmaceuticals.

There is a small variance between the functional foods and nutraceuticals. When food is being cooked using "scientific intelligence" with or without knowledge of how or why it is being used, in that terms the food is called "functional food". Therefore, functional food delivers the body with the sufficient amount of vitamins, fats, proteins, carbohydrates, etc. helps in improving body performance for healthy survival. When functional food plays its role in the anticipation and/or treatment of disease(s) and/or disorder(s) other than anemia, then it is termed as a nutraceutical. Examples of nutraceuticals include fortified dairy products (e.g. milk) and citrus fruits (e.g. orange juice)^[1].

The Dietary Supplement Health and Education Act (DSHEA) normally defined "dietary supplement" using several criteria. A dietary supplement:

Role of DSHEA is :

- It defines and regulate Dietary Supplements.
- Manufactures or the distributors who are providing the dietary supplements or dietary ingredients are banned from marketing products which are misbranded or adulterated. As those suppliers are suppose to evaluate the safety and efficacy also the labelling of product to confirm that they are meeting all the requirements of DSHEA and FDA regulations.
- FDA is usually responsible for taking action against such adulterated or misbranded supplements after they reach to the markets.

According to DSHEA; dietary supplement is:

- is a product (other than tobacco) that is planned to supplement the diet that contains one or more of the nutrients such as vitamin, mineral, herb or a dietary substance used by people to supplement the diet by increasing the total daily intake or a concentrate, metabolite, constituent, extract, or combinations of these ingredients.
- is intended for ingestion in numerous dosage form such as capsule, tablet or in liquid form
- is not given for use as a conventional food or as the complete item of a meal or diet.
- is labelled as a "dietary supplement"^[9].

BENEFITS :

- From the consumers' point of view, functional foods and nutraceuticals may offer many benefits:

- May increase the health value of our diet.
- May help us live longer.
- May help us to avoid particular medical conditions.
- May have a psychological benefit from doing something for oneself.
- May be perceived to be more "natural" than traditional medicine and less likely to produce unpleasant side-effects.
- May present food for populations with special needs (e.g. nutrient-dense foods for the elderly).^[10]

BRIDGING THE GAP BETWEEN FOOD AND MEDICINE

Hippocrates approximately 2000 year ago said that "Let food be your medicine and medicine be your food". Nutraceuticals are foods or food ingredients that provide medical or health benefits. This emerging class of products blurs the line between food and drugs. They do not easily fall into the legal categories of food or drug and often inhabit a grey area between the two.

Within European Union (EU) law the legal categorization of a nutraceutical has been made on the basis of its accepted effects on the body. Thus, if the substance which contributes only to maintain the healthy tissues and organs at that time is said as a food ingredient. But when it shows modifying effect on the body's physiological processes, then it is likely to be considered to be a medicinal substance.^[11]

CLASSIFICATION OF NUTRACEUTICALS

Regarding the promise of nutraceuticals, they should be considered in two ways:

- Potential nutraceuticals
- Established nutraceuticals
- A potential nutraceutical is the one who holds an ability as a particular health or medical benefits. Therefore potential nutraceutical will become an established one only after obtaining a clinical data which will demonstrate such health benefits. It is been noted that the majority of nutraceutical products are in the 'potential' category, and are waiting to become established.^[13]
- The food products used as nutraceutical are categorized as:
 - Probiotic
 - Prebiotic
 - Dietary fibre
 - Omega 3 fatty acid
 - Antioxidant

AREA COVERED BY NUTRACEUTICAL PRODUCTS

• All therapeutic areas such as anti-arthritis. Pain killers, cold and cough also sleeping disorders, digestion and prevention of certain cancers, osteoporosis, blood pressure, cholesterol, depression and diabetes have been successfully covered by nutraceuticals.^[12]

NUTRACEUTICALS REVOLUTION

The nutraceuticals revolution began in the early 1980s, has popped out when the actual or potential clinical benefits of calcium, fibres and fish oil were supported by clinical studies published in distinguished medical journals, and when physicians began to educate their colleagues and consumers about these substances via the mass media.

FACTORS AFFECTING REVOLUTION

- Physician - Increased physician acceptance of the medical benefits of nutritional products increased market demand of nutraceuticals.
- Media- The mass media have emerged as the primary sources of medical claims, mass media has now become the powerful and legitimate promotion agency of nutraceutical products.^[13]

RESEARCH AND DEVELOPMENT

The greatest scientific need in nutraceuticals is the standardization of compounds and/or products, to develop and execute clinical studies/trials to provide the basis for health claims for nutraceuticals that impact consumers as well as companies making strategic investments. Now a days market is showing their interest in nutraceuticals due to:

- Rapid advances in scientific knowledge supporting the vital role of diet in health and disease prevention.
- Skyrocketing health care costs.
- An aging population.
- Technical advances in the food industry that are allowing the development of health promoting foods that can be marketed to health-conscious consumers at a premium.
- The changing regulatory environment.^[14]

ROLE OF R and D IN NUTRACEUTICAL

To test safety, purity and potency of products :

- To develop more effective and efficient ingredients for use in products.

- To develop testing methods for ensuring and verifying the consistency of the dosage of ingredients included in the company's products.
- Develop the new products either by combining existing ingredients used in nutritional supplements or identifying new ingredients that can be used in nutritional supplements.^[15]

MARKET TRENDS OF NUTRACEUTICALS

The nutraceutical industry's three main segments include functional foods, dietary supplements, and herbal/natural products^[5]. Nutrition Business Journal (NBJ) identified an \$80 billion nutraceuticals market in 1995 by considering natural and organic foods (\$6.2 billion), functional foods (\$13.4 billion), certain lesser-evil foods with reduced or no unhealthy ingredients (\$23 billion), dietary supplements (\$8.9 billion), and selected market standard foods (\$28.3 billion). NBJ has begun tracking nutraceuticals industry growth. Since 1995, the industry, as defined by NBJ, has grown by an average of 7.1 percent per year. In 1997, industry sales totaled \$91.7 billion (NBJ 1998). The most rapidly growing segments of the industry were dietary supplements (19.5 percent per year) and natural/herbal products (11.6 percent per year)^[23]. According to BCC Research - The global nutraceuticals market grew to \$46.7 billion in 2002, at an AAGR of nearly 7%. In 2007 nutraceuticals sale is projected to reach \$74.7 billion at an AAGR of 9.9%. This assumes a world economic recovery in 2003 and an end to price competition.^[16]

ISSUE RELATED WITH THE INCORPORATION OF NUTRACEUTICALS IN FOOD

The nutraceuticals such as resveratrol, curcumin, quercetin, sulphoraphane, benzyl isothiocyanate and so forth have various health benefits for humans. Most of them are antioxidants, anticancer, anti-inflammatory, and show heart and brain protective effects. However, utilization of these nutraceuticals in food and drug industry is currently limited because of poor water solubility, pH sensitivity, easy degradation, and low bioavailability. Further, nutraceutical formulations have high molecular weight as compared to pharmaceutical formulations. This restricts the choice of excipients that can be used. The fewer excipients and variety of actives in the same formulation make it difficult to achieve certain desired outcomes such as disintegration time,



hardness, and friability. It also faces the constant challenge of adding the correct amount of each ingredient in to the tablet. Nonuniform content distribution can be more fatal than useful. Also the use of nutraceuticals is not regulated by any laws in most countries. Therefore, there is an increased risk of toxicity and overdose. Increased awareness level about fitness and health, stimulated by media coverage are prompting the majority of people to live healthy lifestyles, by doing exercise, and eating healthy food. The growing nutraceutical market indicates that end users are searching for less processed food with maximum nutritional benefits. This development has set itself for expansion in the nutraceutical markets globally. The emerging nutraceuticals industry seems en-routed to occupy the landscape in the new millennium. Its tremendous growth has implications for the food, pharmaceutical, healthcare, and agricultural industries

Many scientists believe that enzymes represent another exciting boundry in nutraceuticals. "Enzymes have been underemployed. As they're going to be an exciting area in the future." One of the example is fermentation technology using microbes to create new food products also represents potential.

Global trends to healthy products cannot be reversed. Companies taking the lead by investing strategically in science, product development, marketing and consumer education will not go unrewarded.^[17]

FUTURE OF NUTEACEUTICALS AND NUTRACEUTICALS RESEARCH

The consumers are getting health conscious for the simple reason that a human being lives in his body and it is his body about which he is more concerned. On the contrary there are business interests of the commercial entities which have prompted them to expand their business interests to meet the consumer demand. This has led to increased commercial availability in the market of nutraceuticals products containing phytochemicals. However, the scientific evidence supporting their health benefits are still insufficient and what so ever is available is mostly based on in vitro or animal model assays. Clinical trials that may evaluate the actual physiological effects in humans are, however, scarce and where conclusions have been drawn, the findings are controversial. Disagreement of results is not unexpected because there are many challenging factors that may have an impact on the final

outcome of the trials that is, the stability of the bioactive compounds in the different pharmacological forms available and (or) in the gastrointestinal tract. Any chemical alteration of the original bioactive compound that may take place during storage or digestion can severely impact the bioavailability and bioactivity of the compounds.^[17]

At the conclusion we can say that there is a true relationship between diet and health. Food indisputably affects humans but different foods affect each of us differently because everyone has a different genetic makeup. Around 400 BC Hippocrates said, "Let your food be your medicine, and medicine be your food." Nutritious and unhealthy diets are fundamentals of health and disease. There exists some scientific basis to support biological activity of phytochemicals but the task is far from completed and further research is needed. The scientists are widening their area of research to discover the true hidden potentials of phytonutrients/phytochemicals and to authenticate the original claims of the indigenous inhabitants as they appear in history about treatment of different chronic degenerative diseases with plants that have therapeutic properties. We need to look back in the knowledge bank of the entire world to find remedies for the crises created by expensive healthcare and unmanageable chronic diseases. Different nutraceuticals of plant origin may be revealed as essential disease-preventive dietary food components. However, more and better-designed clinical trials need to be carried out in order to prove the benefits of phytochemicals. The future is twinkling in the eyes of scientists—a future that will be better than the past.^[17]

Global Scenario Of Nutraceuticals In 2018 – 2019

The Global Nutraceuticals market accounted for \$379.06 billion in 2017 and expected to grow at a compound annual growth rate(CAGR) of 7.6% to reach \$734.60 billion by 2026. The increasing chances of health disorders and complexions such as obesity, cholesterol, high blood pressure & diabetes and increasing healthcare costs are some of the driving factors supporting market growth. However ingredients and raw material contamination, low awareness among the geriatric population and unclear regulatory guidelines are hampering market.

A nutraceuticals is a nutrient often referred to as a dietary supplement and food additive. The nutraceuticals offer various health and fitness benefits including both prevention and

the treatment of disease, by improving the nutrient value in the food. Nutraceuticals are applied in wide areas such as food & beverage, pharmaceutical, animal feed additives and various personal products.

Based on geography, Asia Pacific is expected to witness major growth due to the increase in health & fitness consciousness among people and increasing disposable income & rapid urbanization in this region. The market is also experiencing new product launches. The rapidly increasing product demand in India, China, and South Korea is helping in increasing the competition. Expansion of the retail sector in emerging economies such as China, Indonesia, Malaysia, and India, in light of

increasing regulatory support, is expected to increase accessibility to buyers over the forecast period

Some of the key players in the nutraceuticals market are Amway Corporation, Abbott Laboratories Inc. Advanced Orthomolecular Research Inc, Ajinomoto Co., Inc., Arista Industries, Archer Daniels Midland Co., Basf Se, Baxter International Inc., Beneo-Orafti S.A., B. Braun Meisungen Ag, Boehringer Ingelheim, Cargill Inc., Cosucra Groupe Warcoing S.A., Croda International Plc, Danisco Als, Groupe Danone S.A., Icu Medical, Herbalife Ltd., Natrol Inc. and Matsun Nutrition.^[18]

Nutraceutical ingredients with their therapeutic applications :

| Sr no. | Nutraceutical Ingredients | Therapeutic Applications |
|--------|----------------------------|--|
| 1 | Probiotics, Prebiotics | Bone and Joint Health Health |
| 2 | Vitamins, Antioxidants | Cancer Risk Reduction |
| 3 | Soya based ingredients | Cardiovascular health |
| 4 | Minerals | Maternal and Infant Health |
| 5 | Nutritional lipids and oil | Immune system |
| 6 | Fibers and carbohydrates | Energy and Eye health |
| 7 | Dairy base ingredients | Skin Health, Respiratory Health Weight Management Cognitive and Mental function Cholesterol Reduction |

Nutraceuticals with their therapeutic benefits^[19,20]

| Name of Nutraceutical | Therapeutic benefit |
|--------------------------------|---|
| 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 Diabetic support |
| Green Tea | Cancer prevention Weight management Lowering cholesterol |
| Gymnema, Momordica | Diabetic control |
| Glucosamine | Arthritis treatment |
| Ginkgo Biloba | Allergy relief |
| Digestive Enzymes | Digestive support |
| Ginseng | Immunomodulator |
| Phycocyanin Powder | Antioxidant |

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REFERENCES :

- [1]. De Felice L Stephen. The nutraceutical revolution, its impact on food industry. Trends in Food Sci. and Tech 1995; 6:59-61.
- [2]. Jack DB. Keep taking the tomatoes - the exciting world of nutraceuticals. Mol Med Today 1995; 1(3):118-21.
- [3]. Brower B. Nutraceuticals: poised for a healthy slice of the market. Nat Biotechnology 1998; 16: 728-33.
- [4]. Mannion M. Nutraceutical revolution continues at foundation for innovation in medicine conference. Am J Nat Med 1998; 5:30-3.
- [5]. Descamps, N., Palzer, S., Roos, Y.H., Fitzpatrick, J.J., 2013. Glass transition and flowability/caking behaviour of maltodextrin DE 21. J. Food Eng. 119, 809–813.
- [6]. Ratnaningrum, D., Budiwati, T.A., Kosasih, W., Pudjiraharti, S., 2015. Sensory and physicochemical evaluation of instant ginger drinks fortified with DFA III. Procedia Chem. 16, 177–183.
- [7]. De Felice L Stephen. The nutraceutical evolution: fueling a powerful, new international market. The Foundation for Innovation in Medicine. Available from: <http://www.fimdefelice.org/archives/arc.fueling.html>.
- [8]. Kalra EK. Nutraceutical-definition and introduction. AAPS PharmSci. 2003; 5:2-3.
- [9]. Sansone, F., Mencherini, T., Picerno, P., d'Amore, M., Aquino, R.P., Lauro, M.R., 2011. Maltodextrin/pectin microparticles by spray drying as carrier for nutraceutical extracts. J. food Eng 105, 468-476.
- [10]. Consumer Association of Canada. Available from: <http://www.consumermanitoba.ca/resources.html>. Accessed on date March 8, 2009
- [11]. Richardson DP. Functional foods—shades of grey: an industry perspective. Nutr. Rev. 1996; 54: 174–180.
- [12]. . Sami Labs — pioneer in nutraceuticals. The Hindu Newspaper; Aug 05, 2002, Available from: <http://www.hinduonnet.com/thehindu/biz/2002/08/05/stories/2002080500040200.htm>.
- [13]. Nutraceutical reality on the horizon-cover story. Food Product Design. Available from: <http://www.pharmabiz.com/article/detnews.asp?articleid=22127§ionid=46>
- [14]. De Busk Ruth. Functional Food. Vegetarian Nutrition. Available from: <http://www.andrews.edu/NUFS/functionalfoods.html>.
- [15]. Nutrition Business Journal, 1:2, September 1996.
- [16]. GA-085R. Evolving nutraceutical, Available from: <http://www.bccresearch.com/food/GA085R.html>.
- [17]. FUNCTIONAL NUTRACEUTICALS: PAST, PRESENT, AND FUTURE Khushwinder Kaur Panjab University, Department of Chemistry and Centre of Advanced Studies in Chemistry, Chandigarh, India
- [18]. (Nutraceuticals - Global Market Outlook) (2017-2026)
- [19]. Sarin R, Sharma M, Singh R, Kumar S. Nutraceuticals; Review, International Research Journal Pharmacy, 3 (4); 2012: 95-99.
- [20]. Patil CS. Current trends and future prospective of nutraceuticals in health promotion, BIOINFO Pharmaceutical Biotechnology 1 (1); 2011: 01-07.