

Nutraceuticals: Let Food be your Medicine.

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Abstract— With the evolution in science and technology followed by the changing lifestyle of individuals the demand for products possessing some medicinal and nutritional value has also been increased. The involvement of nutrients in the form of medicines in human diet has shown promising results and attracted the attention of scientists globally. Nutraceutical can be defined as a food or its part that have the potential of providing certain health related or medical benefits including avoidance of disease. The discovery and history have investigated several aspects of noticeably profound medicinal values of such products. Such products ranges from dietary supplements, nutritional supplements and herbals to fortified and recombinant nutraceuticals. As per estimate of WHO, nearabout 80% of the global population currently uses herbal medicines for some aspect of primary health care. These are the alternative to modern medicines and also provide healthy living. Studies have revealed the promising results for these compounds in various compilations hence, the present review deals with the definition, history, classification and certain health related benefits of different nutraceutical compounds.

Index Terms— Dietary supplements, Fortified, Herbals, Nutraceutical

I. INTRODUCTION

Today, the modern lifestyle acquired by individuals has altered the primary food practices (Padmavathi, 2018), which is considered as the major sufferer of this changed lifestyle. With increase in intake of fast foods, the number of nutritional related deficiencies has also increased. Thus, nutraceuticals play a major role in restraining them (Pandey et al., 2010). Furthermore, from the last few years, consumers prefer food supplements over drugs for their better health because of the negative impacts of drugs, which also bought upliftment in the area of nutraceuticals (Pulipati et al., 2016). Also, the market for nutraceuticals has been well established because of the increased consciousness of scientists and fully developed technologies for determining quantitative and qualitative parameters (Ruchi, 2017). Apart from this, processing and cultivation, local availability, public education, eco-friendly nature and renewability are also some of the reasons behind growing drift of nutraceuticals (Keservani et al., 2010).

In 1989, Dr. Stephen L. DeFelice, chairman and founder of base for innovation in medicines coined the word “nutraceutical” by comprising the terms “pharmaceutical” and “nutrition” as shown in Fig. 1 below. He defined “nutraceutical” as a food or its part that prevent a disease or can be utilized for treating a disease providing certain health-related and medical benefits (Kalra, 2003). They provide additional health-related benefits along with primary nutritive value of food products (Pulipati et al., 2016). They can also be termed as dietary supplements, medical foods and nutritional supplements (Singh and Sinha, 2012). Such type of products ranges from dietary supplements, diets and isolated nutrients to herbal products, genetically modified foods, processed foods like beverages, soups and cereals (Shekhar et al., 2014). They contain lipids, carbohydrates, proteins, minerals, vitamins and other important nutrients (Whitman, 2001).

It can be a natural nutrient rich product like garlic, soy, spirulina or a particular constituent of a product such as ω -3 oil obtained from salmon (Verma and Mishra, 2016). The importance of these products is related with the treatment or prevention of several diseases like cancer, cough and cold, metabolic problems, depression and many more (Ruchi,

2017). Additionally, they support function and structure of body, reduce ageing process, improve health and also enhance life-expectancy (Pulipati et al., 2016). Hence, the present review deals with the classification of nutraceuticals and its role in prevention and treatment of several health-related issues.

Fig. 1 Origination of Nutraceutical term



II. HISTORY OF NUTRACEUTICALS

“Food may own the potential to treat or to prevent a disease” this statement is signified by our predecessors (Ruchi, 2017). For years, the idea of nutraceuticals has been developed substantially and is not a completely new concept (Shekhar et al., 2014). Three thousand years ago, this idea appeared when Hippocrates (460-377 BC), popularly known as the father of modern medicine said that, “Let medicine be the food and food be the medicine” to forecast the link between relevant foods for their medicinal benefits and health, and the reality of this phrase is extensively acknowledged nowadays (Ahmad et al., 2013; Bagchi, 2006).

In the first 1900’s, food manufacturers in US start to add on a little amount of iodized salt for prevention of Goiter (Swaroop and Srinath, 2017). Similarly, honey was also considered capable of showing promising effects as an antihypertensive, antiallergic and vasodilator agent (Viuda-Martos et al., 2008). Furthermore, in the distinct past, botanicals and other plants extracted chemotherapies consisting of *Taxus brevifolia* and *Vinca* species were used to treat cancer and associated problems. Historically, Egyptians recognized the therapeutic significance of cumin, coriander, garlic, curry, turmeric, dried mint, fennel, thyme and juniper (Ruchi, 2017). Hence, from the above context it can be figured out that our surroundings and nature offer a number of natural therapies.

France, UK and Germany regarded diet as a major factor as compared to hereditary factors or exercise to achieve better health (Nwosu and Ubaoji, 2020). In England, Japan and many other countries, nutraceuticals so far have become portion of their dietary plan (Shekhar et al., 2014). In India, they are regarded as component of food obtained from botanical or herbal raw materials that are useful in treatment and prevention of several types of acute and chronic diseases (Navneet et al., 2010). Today, nutraceutical is the fastest growing section of the food industry and worldwide, market for nutraceuticals is expected to grow from \$241 billion in 2019 to \$373 billion in 2025 (Nwosu and Ubaoji, 2020).

3. Classification of nutraceuticals:

For better understanding of applications of nutraceuticals, there is a need to classify them. On the basis of their use they are classified as: Traditional Nutraceuticals and Non-Traditional Nutraceuticals (Ruchi, 2017) as shown in Fig. 2 below:

Traditional Nutraceuticals:

Traditional nutraceuticals include those type of foods which do not go through any physical process and possess health related benefits (Chintale Ashwini et al., 2013). They are present in their natural form as whole foods without any alternation. Many vegetables, fruits, fish, meat and dairy products falls under this category. Moreover, studies also revealed the health-related benefits of chocolate and tea (Swaroop and Srinath, 2017). They are further classified into following:

On the basis of chemical constituents:

- **Nutrients:** AAFCO (1996), defined nutrient as “a food component in a pattern and at an extent that can assist a healthy lifestyle of an individual” (Shinde et al., 2014). The main nutrients are carbohydrates, fats, proteins, vitamins and minerals (Swaroop and Srinath, 2017). Many foods constitute vitamins which are helpful in rehabilitating diseases like cataracts, heart diseases, stroke and osteoporosis. Similarly, minerals present in dairy products, animals and plants are helpful in anemia, osteoporosis, formation of strong teeth, muscles and bones, improving heart rhythm etc. (Chauhan et al., 2013).

therapeutic properties and are used in the prevention of or treatment of a disease. It can be a fresh plant or any of its part like stem, dried leaf, roots, concentrated extract, fruit etc. (Singh et al., 2012). They contain diverse active phytochemicals like terpenoids, polyphenols, flavonoids and saponins (Nwosu and Ubaoji, 2020).

- **Phytochemicals:** They are also known as Phytonutrients. They are the chemical components of plants possessing a biological action (Zhao, 2007). Studies revealed that they contain active compounds which affects biochemical and metabolic actions in living organisms hence providing health benefits (Dillard and German, 2000).

Probiotic organisms:

Probiotics stands for “for life”. It includes foods containing microbial cells in living form that are beneficial to health. They eliminate harmful pathogens like viruses, other bacteria or fungi that may cause disease and acts on digestive tract at particular sites (Sapkale et al., 2012; Singh et al., 2012; Gibson, 2004; Quigley, 2010). They possess antimicrobial effect by altering microflora, prevent sticking of microbes to intestinal lining, building an antitoxic effect etc. (Singh and Sinha, 2012).

Nutritional enzymes:

These are the type of enzymes derived from microbial, plant or animal sources. Disease like diabetes, obesity and digestive problems can be controlled by adding enzymes additives in the diet. They play an important role in our life as without them our body would not be able to function properly (Nwosu and Ubaoji, 2020).

Non-Traditional Nutraceuticals:

These are artificial foods advanced by biotechnology. The foods in which their nutritive value is improved by adding certain dietary components or nutrients falls under this category. They are further subdivided into recombinant and fortified nutraceuticals (Singh and Sinha, 2012).

Recombinant Nutraceuticals:

They include the production of bioactive compounds and probiotics either by genetic engineering or by fermentation/enzyme technology. Furthermore, energy-giving foods like alcohol, cheese, yoghurt, fermented starch, vinegar, bread etc. are developed by application of new biotechnology (Singh and Sinha, 2012).

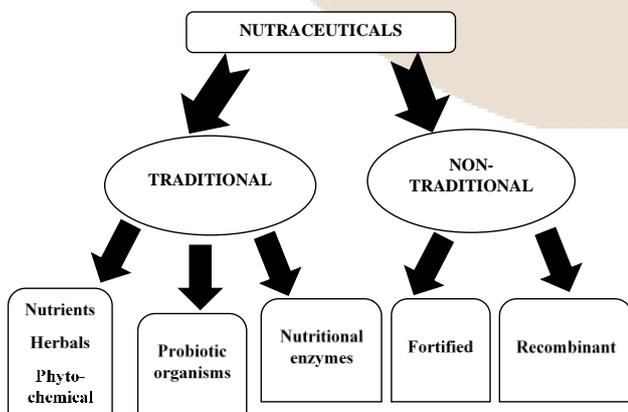
Fortified Nutraceuticals:

Fortification can be defined as process in which certain micronutrients including vitamins and trace elements are added to food in order to enhance its nutritive value and effectiveness (Ruchi, 2017). Table 1 below shows examples of different types of nutraceuticals along with its health benefits.

Table 1: Some examples of different types of nutraceuticals.

S. No.	Type of nutraceutical	Example	Reference
1.	Traditional	Lycopene from tomatoes, saponins from soy, omega-3 oil from salmon	Sapkale et al., 2012; Nwosu and Ubaoji,

Fig. 2 Classification of Nutraceuticals



- **Herbals:** This category includes the herbs that possess

			2020
2.	Non-traditional	Rice enriched with beta-carotene	Sapkale et al., 2012;
3.	Herbals	Proanthocyanadin from cranberry used to prevent or treat ulcer, cancer; menthol present in peppermint helpful in curing flu and cold, tannin in lavender helpful in treating hypertension, cold, asthma	Singh and Sinha, 2012
4.	Fortified	Fortification of orange juice by calcium; addition of folic acid to flour; milk fortification by cholecalciferol helpful in deficiency of vitamin D; cereals fortified with minerals or vitamins	Casey et al., 2010; Nwosu and Ubaoji, 2020
5.	Recombinant	Genetically modified gold kiwifruit to obtain an increase in lutein, carotenoids, zeaxanthin and ascorbic acid; lactoferrin deficient cows engineered by rh human lactoferrin to cover up the deficiency	Beck et al., 2011; Hyvonen et al., 2006
6.	Phytochemicals	Flavonoid polyphenols present in F&V, berries, legumes control diabetes & prevent prostate and breast cancer; broccoli seeds containing isothiocyanates possess antitumorogenic activity	Singh and Sinha, 2012
7.	Probiotics	Helpful to treat lactose intolerance by increasing the formation of an enzyme named beta-galactosidase	Oak and Jha, 2019

CONCLUSION

In one or the other way, several studies have confirmed the major importance of nutraceuticals for treating and preventing many diseases. Majority of people favor the avoidance of a disease by a natural therapy that can be attained with inclusion of these nutraceuticals' compounds in daily diet. The intake of such products can be considered better way to remain natural followed by improved life quality. Furthermore, these products are substitute for people who don't prefer chemical treatment it is also cheap as compared to other therapies. Globally, market demand for these products is also increasing. Market researches also shows increasing interest of consumers towards nutraceuticals that is a positive sign for nutraceuticals industries. Nevertheless, these is a wide scope for evolution of these products of human diet and market. Therefore, in the upcoming future nutraceuticals have the potential to the best alternative in order to attain better and easy healthy life.

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