

**DRAGON FRUIT AS A NUTRACEUTICALS****Shinde Mayuri S.^{1*} Aher Smita S.², Saudagar R. B.²**

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ABSTRACT

The concept of Nutraceutical was started from the survey in Germany, U.K. and France which concluded that diet is rated more highly by consumers than exercise or hereditary factors for achieving good health. Nutraceutical is an any substance that is a food or part of food and provides health or medicinal benefits, including the treatment and prevention of disease. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered designer foods and herbal products. The nutraceutical revolution will lead us into a new era of medicine and health, in which the food industry will become a research oriented one similar to the pharmaceutical industry. Dragon fruit have activity of antioxidants can also prevent inflammatory diseases such as gout and arthritis. Pitaya

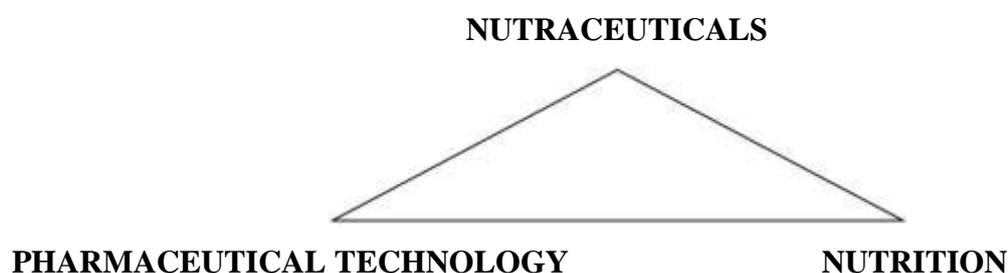
fruits have a high dosage of Vitamin C, Vitamin A, B1, B12 and E. Mineral contents in dragon fruits include a good dosage of potassium, magnesium, zinc, and phosphorus. In smaller amounts, it has calcium, copper and iron.

KEYWORDS: Nutraceuticals, Dietary Supplement, Functional Food, Medicinal Food, Dragon Fruit.

INTRODUCTION

The quality of life in terms of income, lifestyle and spending has improved with economic development. However, it has also thrown up a major challenge in the form of 'lifestyle diseases'. The first victim of this lifestyle change has been food habits. Consumption of junk food has increased manifold, which has led to a number of diseases related to nutritional

deficiencies. The term nutraceutical was coined from nutrition and pharmaceutical in 1989 by Stephen Defelice, founder and chairman of foundation for innovation in medicine, an America organization which encourages medical health. According to them “a nutraceutical is any substance that is a food or a part of food and provides medical or health benefits, including the prevention and treatment of disease”.^[1] The concept of nutraceutical was started from the survey in U.K., Germany and France and it concluded that diet is rated more highly by consumer than exercise or hereditary factors to achieving a good health. In the U.S. “nutraceutical” was commonly used, but no regulatory definition existed. The Ministry of Health Canada which defines nutraceutical as “a product purified and isolated from the food, generally sold in medicinal form not associated with food and demonstrated to have a physiological benefit. It also provides benefit against chronic disease.”



CLASSIFICATION OF NUTRACEUTICALS^[2]

Nutraceuticals can be classified as follows:

A) On the basis of natural source:

Products can be obtained from-

- Plants- e.g. Indole-3-carbinol(cabbage), lycopene (tomatoes).
- Animals- e.g. EPA and DHA (fish oil).
- Minerals- e.g. selenium, iodine.
- Microbes- e.g. Phycocyanobilin (Spirulina), lactobacillus (yogurt).

B) Nutraceuticals on basis of below properties:

- Potential Nutraceuticals (plant-foods polyphenols for diabetes).
- Established Nutraceuticals (polyvitamins, omega-3 fatty acids).

C) Most widely used food sources as Nutraceuticals are of natural sources and can be categorized as follows:

- Dietary fibre- e.g. beans, fruits
- Probiotics- e.g. yogurt, dark chocolate
- Prebiotics- e.g. Asparagus, almonds, apples
- Polyunsaturated fatty acids- e.g. olive oil, walnuts
- Antioxidants vitamins- e.g. vitamin C, vitamin E
- Polyphenols- e.g. tea, coffee, spinach
- Spices- e.g. garlic, turmeric.

D) On the basis of pharmacological conditions, or as per chemical constituents of the products.

CATEGORY OF NUTRACEUTICALS^[3]

Nutraceuticals are non specific used to promote wellness, prevent malignant processes and control symptoms. They are categorized as follows.

- **NUTRIENTS**

Substances with nutritional functions, such as vitamins, minerals, amino acids and fatty acids, Common nutrients and their associated health benefits.

Table 1: List of nutrients and their relevance.^[4]

Nutrients	Health benefit
Vitamin A	Antioxidant, essential, for growth and development and in the treatment of certain skin disorders.
Vitamin E	Antioxidant, helps form blood cells, muscles, lung and nerve tissue, boosts the immune system.
Vitamin K	Essential for blood clotting.
Vitamin C	Antioxidant, for healthy bones, gums, teeth and skin, in wound healing, prevent common cold and attenuate its symptoms.
Vitamin B1	It Helps to convert food in to energy, essential in neurologic functions
Vitamin B2	It Helps in energy production and other chemical processes in the body, helps maintain healthy eyes, skin and nerve function.
Vitamin B3	Helps to convert food in to energy and maintain proper brain function.
Folic acid	It Produce the genetic materials of cells, in pregnancy for preventing birth defects, RBCs formation, protects against heart disease.

- **HERBALS**

Herbs or botanical products as concentrates and extracts. Common herbs and their therapeutic relevance.

Table 2: Herbals used and their therapeutic relevance.^[5]

Herbals (Botanical source)	Therapeutic activity
Aloe Vera gel (Aloe Vera L. N.L. Burm.)	Dilates capillaries, anti-inflammatory, emollient, wound healing properties.
Ephedra (Ephedra sinica Stapf.)	Bronchodilator, vasoconstrictor, reduces bronchial Edema
Garlic (Allium sativum L.)	Antibacterial, antifungal, antithrombotic, hypotensive anti-inflammatory

- **DIETARY SUPPLEMENTS**

A Dietary supplement is a product that contains nutrients derived from food products that are concentrated in capsule or liquid form. Dietary supplements, such as the vitamin B supplement show above, are typically sold in pill form. The dietary supplements Health and Education Act of 1994 defined generally what constitutes a dietary supplement. A dietary supplement is a product taken by orally it contains a "dietary ingredient" intended to supplement the diet. Dietary supplements do not have to be approved by the U.S. Food and Drug Administration (FDA) before marketing. Dietary supplements provide various health benefits, products usually include a label that says: "These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease." Dietary Nutraceuticals involves as vitamins, minerals, herbs and other amino acids, substances such as enzymes, organ tissues, glandulars, and metabolites. Dietary supplements found in many forms such as tablets, capsules, liquids, softgels, gelcaps or powders.

- **FUNCTIONAL FOODS**

Functional foods are mainly design to allow consumers to eat enriched food close to their natural state, rather than by taking dietary supplements. They manufactured in liquid or capsule form. Functional foods have been enriched or fortified, a process called nutrification. This practice store content back in food to similar levels from before the food was processed. many times additional complementary nutrients are added, such as vitamin D to milk. As per the Health Canada functional foods as "ordinary food that has components or ingredients added to give it a specific physiological or medical benefit, other than a purely nutritional effect." In Japan country all functional foods must meet three requirements: foods should be

- Present in their naturally-occurring form, rather than a capsule, tablet, or powder;
- Should regulate a biological process in hopes of preventing or controlling disease and
- Consumed daily diet as often as daily.

- **MEDICAL FOODS**

Medical foods are not available as an OTC product to consumers. Food Drug Administration considers medical foods to be “formulated consumed or administered internally under the supervision of a physician, and which is intended for the specific dietary management of Disease conditions for nutritional requirements, on the basis of recognized scientific principles, are established by medical evaluation.” Nutraceuticals and supplements do not meet these requirements and are not classified as Medical Foods. Medical foods are always designed to meet certain nutritional requirements for people diagnosed with specific illnesses. Medical foods are regulated by the FDA and will be prescribed by medical supervision. Medical food can be ingested through through tube feeding and through mouth.

TRADITIONAL AND NON- TRADITIONAL NUTRACEUTICALS

Various type of Nutraceutical foods are available in the market which falls in the category of Traditional foods and Non Traditional foods.

- **TRADITIONAL NUTRACEUTICALS**

In the category of Traditional Nutraceuticals comes food in which there is no change to the food are made. It is simply natural and whole foods with new information about their potential health qualities. There has been no change to the actual foods, other than the way the consumer perceives them. Even tea and chocolate have been noted in some studies to contain health-benefiting attributes. Grains, dairy products, Fruits, fish, vegetables and meat products contain several natural components that deliver benefits beyond basic nutrition like lycopene in tomatoes, omega-3 fatty acids in salmon or saponins in soy. Tomatoes and Salmon are the two types of food that researchers have found to contain benefits beyond basic nutrition - in this case, lycopene and omega-3 fatty acids, respectively.

- **NON TRADITIONALNUTRACEUTICALS^[6]**

They are the outcome from agricultural breeding or added nutrients and ingredients such as orange juice fortified with calcium, cereals with added vitamins or minerals and flour with added folic acid are non traditional nutraceutical. Agricultural scientists successfully have

come up with the techniques to boost the nutritional content of certain crops. Research currently is being conducted to improve the nutritional quality of many other crops.

SCOPE AND OPPORTUNITY INDIAN NUTRACEUTICAL MARKETS^[7,8,9]

The Nutraceutical market in India valued at \$ 1,480 million in 2011 could grow to \$ 2,731 million in 2016, a report said today. According to the report by business research and consulting firm Frost & Sullivan, functional foods will be the quickest growing category followed by dietary supplements until 2015. However, dietary supplements specifically diet supplements, will form the greatest opportunity areas for nutraceutical manufacturers, it added. Nutraceutical is a combination of the words 'nutrition' and 'pharmaceutical', is a food or food product that reportedly provides health and medical benefits, including the prevention and treatment of diseases. The report said that at present the dietary supplements were the largest category accounting for 64% of the nutraceuticals market. This nutraceutical market is driven primarily by the pharmaceutical sector in the form of vitamin and mineral supplements, it added. According to the study the global nutraceutical market was estimated to be \$ 149.5 billion in 2011 with US, Europe and Japan being the largest regional markets, accounting for nearly 93 % of the global nutraceutical demand. Government is chip in funding vitamin fortification initiatives due to increasing food security concerns in India and need for additional nutrition.

RATIONALE FOR USE OF NUTRACEUTICALS^[10,11,12,13]

Dietary factors play an important role in premature chronic disease appearance, disease progression, morbidity and mortality. Approximately 40-50% proportion in cardiovascular disorders, 35-50% proportion in cancers, and 20% proportion in osteoporosis is attributable to dietary factors. Use of food as medicine for treatment and prevention of various disorders is not a recent development. Fortification of table salt with iodine and wheat flour with iron/folic acid has been used with specific aims of prevention of iodine deficiency goiter and anemia for long. Similarly, food fortified with vitamin A has been found to be a feasible and cost-effective approach to reduce vitamin A deficiency.

NUTRACEUTICALS AND DISEASES^[14,15,16,17,18]

Nutraceuticals are newly receiving as being beneficial in coronary heart disease, diabetes, obesity, cancer, osteoporosis and other chronic and degenerative diseases such as Parkinson's and Alzheimer's diseases. Evidences indicate that the mechanical actions of natural compounds involve a wide variety of biological processes, including activation of antioxidant

defenses, signal transduction pathways, cell survival-associated gene expression, cell proliferation and differentiation and preservation of mitochondrial integrity. It appears that these properties play a crucial role in the protection against the pathologies of numerous age-related or chronic disease. It is very important that the nutrients found in many foods, fruits and vegetables are responsible for the well documented health benefits. For example, lutein and xanthin prevent cataracts and macular degeneration; beta-carotene and lycopene protect the skin from ultraviolet radiation damage; lutein and lycopene may benefit cardiovascular health, and lycopene may help prevent prostate cancer.

Various nutraceuticals used against different diseases

S.N.	Disease	Example
1	Alzheimer	Vit E & C, Alpha-lipoic acid
2	Cardiovascular	Flavonoids (Onion, Black Grapes)
3	Parkinson	Vit E
4	Obesity	Chitosan, Fenugreek, Vit C
5	Osteoarthritis	Glucosamine, Chondroitin Sulfate
6	Constipation	Buck Wheat
7	Vision Improving	Carrot, Mangoes, Spinach, Kiwi, Egg yolk
8	Antioxidant	Oats, Fruits, Carrots
9	Anti Inflammatory	Turmeric
10	Hypertension	Curry Leaf, Green Tea

BENEFITS^[3]

As per 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 received 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).

DRAGON FRUIT^[19]**Fig 1: Dragon fruit.**

- Dragon fruit with a yellow or red epicarp and a white or red mucilaginous pulp. Fruit is a berry up to 7-14 cm long and 5-9 cm thick, Every Dragon fruit contains numerous tiny black seeds.
- Fruits in daily dietary practices has made room for different, even exotic fruit species with distinctive flavor and interesting mineral, fiber and antioxidant contents.
- It is native in Central America and cultivated in tropical regions around the world.
- Dragon fruit extract is obtained from the fruit of *Hylocereus undatus*.

TWO TYPES OF DRAGON FRUIT

- Red Skinned Dragon Fruit.
- Yellow Skinned Dragon Fruit.

Red Skinned and Yellow Skinned Dragon Fruit

- The skin of dragon fruit is covered in 'scales' and comes either as a yellow skinned or red skinned variety. The stems from the dragon give many benefits that dragon fruit has to offer. Generally, the red-skinned variety with red flesh offers more benefits compared to the yellow or the red-skinned.
- The red-skinned variety comes either as white or luminous red flesh. The yellow-skinned variety is available only in white flesh variety. (with white flesh).



Fig. 2: Red Skinned Dragon Fruit.



Fig. 3: Yellow Skinned Dragon Fruit.

DRAGON FRUIT PLANT



Fig. 4: Dragon fruit plant.

DRAGON FRUIT TASTE

- Dragon fruit may look exotic and unique, but the taste can be bland and uninteresting. Not fiery and intense just like its name.
- Red flesh variety is sweeter.

HOW TO EAT DRAGON FRUIT

- You can cut it in half and spoon it out or cut into quarters, peel the skin off and serve on a plate. It tastes better if it is chilled. Some people will add a bit of lime juice for added flavor.
- Or you can cut it into cubes and serve it as part of your mix fruit salad.
- For something different, try it as fruit juice, sorbet, or smoothy .You do not eat the dragon fruit skin, in some Southeast Asian countries, the skin is pickled and eaten either on its own or with salad.
- Based on a study by the Faculty of Chemical Engineering and Natural Resources, the peel or the skin is actually rich in flavonoids, which is good for anti-inflammatory, anti-tumor, and anti-viral effects.

DRAGON FRUIT FACTS

- If Dragon fruit tree maintained properly, can last for over a hundred years.
- Dragon Fruit flowers blooms only at night and only on that night Pollination needs to happen on one night for it to set fruit.

HOW TO CHOOSE A RIPE DRAGON FRUIT

- Matured dragon fruit is mainly choose one and ready fruit to eat If you press it with your thumb and it gives a little, then it is perfect for eating. If it is soft, then it is over-ripe and the flesh may be too runny. If it is very firm, then you need to rest it for couple of days for it to ripen.
- Do not keep it too long otherwise, it will be too soft. You are not ready to eat it yet then put it in fridge, it will stay fine for a week or so.
- Those that do not have blemishes are usually priced higher. I find the quality and taste of the dragon fruit flesh from those with and without blemishes is no different. So, save your money!
- But do not buy if it has too many blotches or blemishes as it may be over-ripe. Another sign of over-ripe dragon fruit is the dry and brown tips of its 'leaves'.

DRAGON FRUIT SEED CONTAINS OMEGA-3 & OMEGA-9

The flesh has a nice texture with tiny seeds all over, just like kiwi fruits. But do not be put by these tiny seeds as there are edible and nutritional. The seeds contain natural oils and fatty acids in the form of linoleic acid and oleic acid (Omega-3 and Omega-9), which are useful for your cardiovascular health.



Fig. 5: Dragon fruit with red and white flesh containing seeds.

BENEFITS OF DRAGON FRUIT

Dragon fruits nutritional Benefits recently investigated by only the universities and Cancer research centers, and these benefits are as follows:

A) Dragon Fruit for People with Type 2 Diabetes

- Statistic shows that people that suffer from diabetes has an increased chances of vascular complications by at least twofold.
- Based on the overall study conducted by the School of Pharmaceutical Sciences of *Universiti Sains Malaysia*, and published in the US National Library of Medicine National Institutes of Health, dragon fruits, which is rich in antioxidant betacyanins, can prevent this combative stress and diabetes.
- In other study on patients with Type 2 diabetes who are not dependent on insulin, shows a decrease in blood sugar level by more than 19% when given 600 gm daily dosage of the red flesh red-skinned dragon fruit over a period of four weeks.
- In the red flesh dragon fruit Flavonoids and antioxidants is responsible for this reduction of glucose level and hence, if you suffer from Type 2 diabetes, eating the red flesh dragon fruit can help control your glucose level.

RED FLESH DRAGON FRUIT



Fig 6: Dragon Fruit With Red flesh.

B) Dragon Fruit May Reduce Cancer Risk

- Red flesh dragon fruit containing red pigment is rich in flavonoids, antioxidants, lycopene and phytoalbumins, which can help prevent the formation of cancerous cells.
- As documented in American Institute for Cancer Research eNews, the phytochemical lycopene that is present in red flesh dragon fruit can prevent prostate cancer.
- It is most important to note that you must lead a healthy lifestyle and go on an anti-cancer diet to help improve your chances of preventing cancer.
- In addition, antioxidants can also prevent inflammatory diseases such as gout and arthritis.

WHITE FLESH DRAGON FRUIT

Fig. 7: Dragon fruit with white flesh.

C) Dragon Fruit May Reduce Cholesterol

- Dragon fruit has high levels of both the insoluble and soluble fiber. 1 gm of fiber get from 100 gm of fresh dragon fruit. In dried form, the fiber content is even more at 10 gm for every 100 gm of the powdered or dried fruit.
- This fibers can improves the digestive system, will reduce the accumulation of dietary cholesterol in your system.
- In a clinical study published in the American Journal of Applied Sciences 6 (7): 1341-1346, 2009 edition, eating the red dragon fruit over five weeks, saw an impressive drop in the total cholesterol level.

D) Prebiotic Action of Dragon Fruit

- On the basis of the article in 'Food Chemistry' (June 2010 edition), the fiber in dragon fruit is made up mainly of oligosaccharides. This is not digested in the stomach, but act as prebiotics, which assists in the growth of lactobacilli and bifidobacteria, which are the healthy bacteria.
- When taken in the right amount, these microorganisms will assist in the digestion and keep the immune system strong.

E) Proteins, Carbohydrates and Calories in Dragon Fruit

- 2.0 g of protein get from 100 g of dragon fruit and 9 g of carbohydrates, which is about 3% and 4% of the recommended daily value, respectively.
- Dragon fruit is also very low in calories at only 60 calories, which is about 3% of the daily value
- This is good news if you are on a weight management program.

F) Vitamins & Minerals in Dragon Fruits

- Pitaya fruits have a high dosage of Vitamin C where 100 gm of the fruit will give 500 mg of Vitamin C. It also contains Vitamin A, B1, B12 and E, but in smaller amounts.
- Mineral contents in dragon fruits include a good dosage of potassium, magnesium, zinc, and phosphorus.
- In smaller amounts, it has calcium, copper and iron.
- Hence, with all these nutritional benefits, dragon fruit can be a complete meal of its own.
- Please refer to the table below for detail breakdown of the vitamins and mineral contents.

Dragon Fruit Nutrition Facts

Nutrients	Nutritional 100g Value per	Health Benefits
Protein	2.0 g	To build and repair tissues, to make hormones, enzymes and assist the body to release energy
Calcium	5.7mg	For strong and healthy bones
Potassium	57mg	Assists in carbohydrate metabolism, & regulate blood pressure and cardiovascular health
Magnesium	28mg	Regulate body temperature, detoxification, energy production
Ascorbic Acid (Vit C)	500mg	Strengthen immune system, heals bruises and cuts faster.
Vitamin E	106 µg	Protection against toxin, thins the blood & helps in the skin and hair care
Cobalamin (Vit B12)	16 µg	For healthy nerve cells & red blood cells
Phosphorus	23mg	For tissue formation
Retinol (Vit A)	20 µg	For body detoxification, skin health and improves night vision
Iron	3.4mg	For red blood cells production & for body energy
Copper	31 µg	For a healthy bone, tissue & thyroid gland
Zinc	14mg	Improves brain appetite function & to control
Thiamine (Vit B1)	48.9 µg	Assists in production of energy as well as metabolizing carbohydrates
Lycopene	14.35 mg	Helps keep the body healthy and protect against harmful damage caused by free radicals

Dragon Fruit and Pregnancy

- Fruits must be part of a pregnancy diet and with all the richness in vitamins, minerals, fiber and fatty acids in red dragon fruit, eating the fruit on a daily basis will be beneficial to a pregnant woman and her unborn baby.
- Among its many benefits is its iron content that will assist a pregnant woman's demand for iron. This will help reduce chances of anemia. It also contains folates, which is essential for the formation of red blood cells.
- Eat it fresh, as part of your mixed fruit salad, as a juice or as smoothies.

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