

# NUTRACEUTICAL A REVIEW ON: BASIC NEED, CLASSIFICATION, RECENT TRENDS IN INDUSTRY AND DELIVERY SYSTEMS

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## Abstract:-

Nutraceuticals are any substance, i.e. Food or part of food used for nutritional purposes and provided medical and health benefits. In today's scenario nutraceutical supplements are used as an alternative to pharmaceutical medicine and the physician also preferred nutraceutical supplements in various life-threatening diseases like hypertension, diabetes mellitus, gastrointestinal diseases, etc.

The evolution of the nutraceutical industry in recent years because of certain things or trends emerging and gaining popularity all over the world. These trends are the use of cannabis (cannabidiol) in nutraceuticals, nutricosmetics, nutritional supplements for pets, the plastic packaging problem with nutraceutical, sports nutrition supplement, and most important online marketing strategies for nutraceutical product marketing.

There are various techniques like spray drying, extrusion is used for formulating nutraceutical products. As the market of nutraceuticals grows all over the globe, the delivery systems also change. In the nutraceutical industry various delivery systems are used like nanoemulsion, nanoparticles, Probiotics, liposomes, and micelles, it gives the targeted delivery of nutritional elements.

**Keywords:** Nutraceutical, life-threatening, cannabis, nutricosmetics, online marketing, Probiotics, Delivery systems.

## Introduction:-

A nutraceutical is any substance that is a food or part of the food & provides medical and health benefits [35]. Including the prevention & treatment of diseases or the pharmaceutical preserved product used for human wellness & health [4][5]. In today scenario in all over the world, the popularity & the use of nutraceutical supplement increases [20]. People mostly preferred the nutraceutical product instead of medicine because of their high cost and side effects. The people are more aware of their health, immunity lifestyle. Therefore, they mostly preferred nutraceutical supplements [36].

They use various emerging trends in the nutraceutical industry like the use of cannabis (cannabidiol) as a nutritional product but they have certain limits on their use [64]. The other trend is nutricosmetics. The market of nutricosmetics is increases all over the globe, this is because the use of nutricosmetics increases for beautification, improves the appearance of the skin, good personality [8][12]. The use of nutricosmetics is highest in the women as compared to the man. But the popularity of men's nutricosmetics has also increased.

Now a day physicians also preferred nutraceutical supplements for various diseases like diabetes mellitus, hypertension, heart diseases, gastrointestinal disease (GERD, improper digestion, gastric ulcer) vitamin deficiency [19] [29] [30] [37]. Therefore, there is a slow transition from pharmaceutical medicine to nutraceutical supplements [33] [36].

The nutraceutical mainly consists of proteins, vitamins, antioxidants, dietary fibers, fatty acid, carbohydrates, amino acid, which help the human to improve the health, gaining energy & boosting the immunity [5] [14].

The other consumer group for the nutraceutical supplement is pets. The pet owner is more cautious about the health of pets. They are one of the most important parts of the nutraceutical industry. The pet owner buys supplements for pet health and wellness [54][56]. The one of the approaches in nutraceutical, the plastic packaging problem, the some of the nutraceutical supplement isn't compatible with the plastic & also the fine plastic packaging creates the negative impact on the environment & because of their slow degradation, harmful effect on the environment, therefore to find an alternative for the plastic is emerging & innovative trend in nutraceutical industry [1][2][60][62]. Nutraceutical supplement is also used in sports as a nutritional product, to gain energy & stronger the immunity power. Wide range of nutraceutical supplements used in sports. Therefore, the market size of the nutraceutical product is increases and achieves the highest level globally [65].

Now a day, online marketing of nutraceuticals is a very popular trend. There are a different number of strategies use for online marketing like email, social media (Twitter, Facebook, Instagram) etc. Therefore nutraceutical market achieves highest level all over globe.

**Basic need:-**

- 1) The human body consist of various organ system for the proper growth of the organ & system, there will be required of nutrient, but some of the people are deficient such nutrients, therefore in such case, we need a nutraceutical supplement [4].
- 2) In various diseases like diabetes mellitus, hypertension, gastrointestinal diseases, anemia [5][16] [17].
- 3) For twinning the energy & boosting the immunity for human wellness & health [4].
- 4) Geriatrics patient has many health-related problems because they have low immune power [17].
- 5) Maintains the normal physiological function of the body [29].
- 6) In children nutraceutical supplement needs for their growth & development [4].
- 7) It is an alternative for medicine because of the cost of the treatment, medicine & expensive & also have many side effects [23]
- 8) Nutraceutical is also used in obesity, metabolic disorder, cardiovascular and neurodegenerative diseases [23, 31].

**Nutraceutical Classification:-**

The classification of nutraceutical based on food availability.

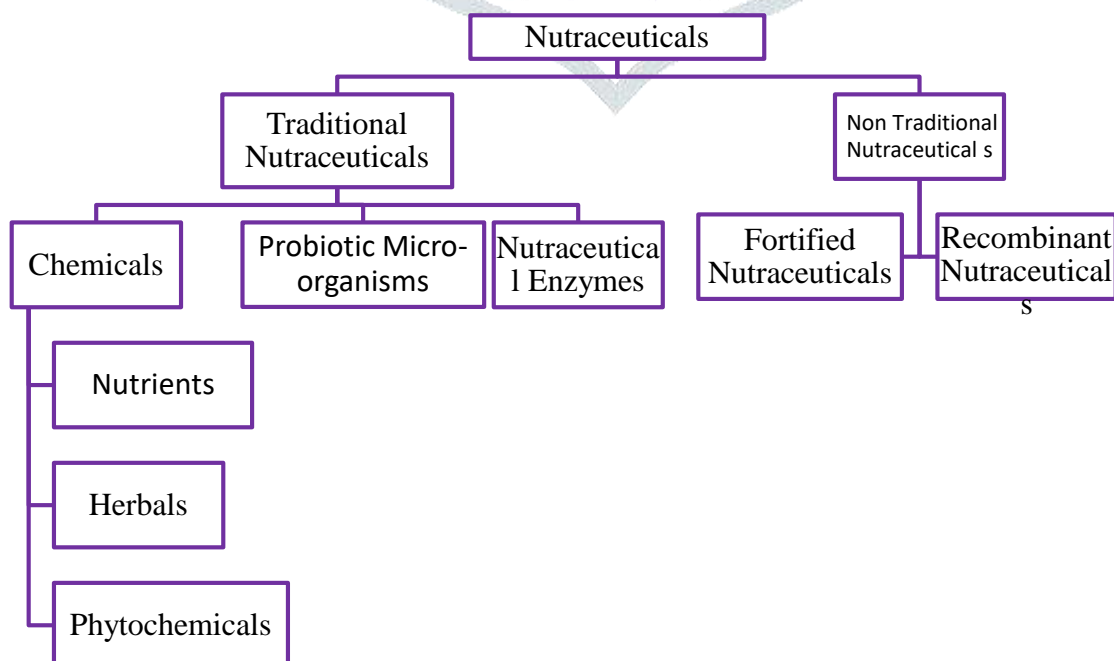


Fig 1:- Classification of Nutraceuticals

**A) Traditional nutraceutical:-**

These types of nutraceutical are obtained from natural sources without any change in their form i.e. parts of plant and herbs. The food containing naturally occurring components that give benefits to human beings [5,25,28].

Eg. Lyopene in tomatoes, omega 3 fatty acids in salmon and Saponin in soy, etc [16]

**1) Chemical constituents:-****a) Nutrients:-**

Nutrients are primary metabolite substances obtained from plants and animals useful in growth and development and various metabolic pathways in humans [28]. These are not chemically derived products or food. i.e naturally occurring food contains the amino acid, vitamins, and fatty acids, etc [5, 14].

e.g. Amino acid, Vitamins, Fatty acids (omega 2 PUFA) [5] [19] [25]

**Use:-**

- 1) They play an important role in various metabolic processes [29][30]
- 2) Nutrients are useful in diseases related to heart, Kidney, and lung osteoporosis, anemia etc [5].
- 3) Fatty acid omega 2 PUFA affects the antiinflammatory response and decrease cholesterol level [5]
- 4) Vitamin E supplement used in Parkinson's disease [29,30].
- 5) Amino acid L arginine improves the exercise capacity and enhance the depressed immune response of individual suffering from injury and surgical trauma. [8] [24]

**b) Herbal:-**

These type of chemical constituents consist of naturally occurring herbs and part of the herb, they have their own nutritional value [14,19,28].

Table 1:- Herbal plants and their active constituent as a nutraceutical

Common Name	Biological source	Active constituent	Uses
Salix nigra[5]	willow bark of Salisnigra	Salicin	Anti inflammatory Antipyretic, Astringent Anti arithmetic[5]
Peppermint [5]	Mentha piperita	Menthol	Cures cold and flu[5]
Garlic [13]	Dried bulb of Allivumsativum	Alline and allicin	Antigout, Antibacterial, Nerve tonic [13]
Ginger [13]	Rhizomes of Zingiberofficinale	Znigiberenegingerol	Chronic bronchitis, Hyperglycemia, Throat ache [13]
Bael 13]	Unripe fruit of Aeglemarmelos Corr.	Marmelosin	Treatment of diarrhea and dysentery [13]

### c) Phytochemicals:-.

(Plant Chemicals - Chemically active constituent in plants)

Phytochemicals can be classified on the based on chemicals name on the basis of their properties [5]. These are secondary metabolites of plants chemically distinguished into separate groups [28,14]

Table 2:-Carotenoids [12]

Name of Carotenoids	Source	Use
$\beta$ carotene [26]	Berseem, lucern, oat maize fodder	Neutralizes free radicals [26]
Zeoxanthine [32]	Egg, Citrus, Corns	Healthy vision
Lycopene [26]	Tomatoes	Reduce prostate cancer [26]

Table 3:- Phenolic acid

Name of phenolic acid	Source	Use
Caffeic acid & chlorogenic acid [26]	Citrus fruit	Antioxidant, Anticancer [26]
Hydroxycinnamic acid	Red Wine	Antitumor

Table 4:-Flavenoids

Group of flavenoids	Source	Use
Pronthyacynidine[28]	Cocca, Chocolate, Tea	Reduce CVD
Anthocynidine [32]	Fruits	Neutralizes the free radical, reduce risk of cancer
Catechin	Tea, Babool pods, Musard cake	Antioxidants

## 2) Probiotic microorganisms

In 1974 definition given by Parker of probiotic microorganisms are "Organism and substances which contribute to intestinal microbial balance"[44].

Food and Agricultural Organization of the united nation (FAO) and the World Health Organization defined probiotic as "live microorganisms than when consuming adequate amount and confer a health benefit on the host" [9, 44].

The probiotic mainly act on the pathogen, harmful bacteria, yeast in the intestine and develop the symbiosis or homeostasis in the gastrointestinal tract, altering the microbial flora in the GI tract. These are the bacteria that improve absorption and adsorption of nutrients [5,10,11].

Probiotics have antimicrobial activity by altering the microbial flora, they also prevent the adhesion of pathogens in the intestinal epithelium and make competition with the nutrients essential for the growth of pathogens and preventing from microorganism causes GI tract illness and diseases [5, 10]. Another mechanism is it made the gastrointestinal epithelium more liable for the retention of dietary supplements for better absorption [10].

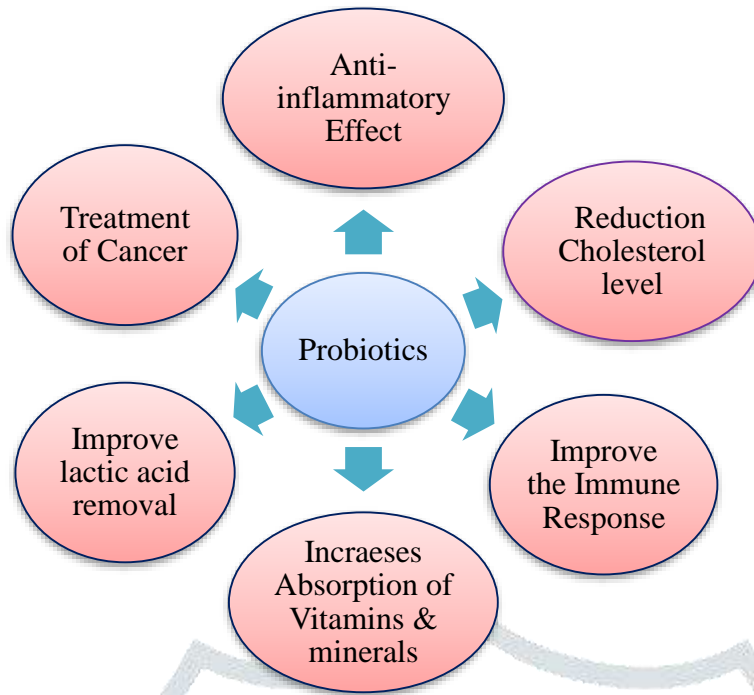


Fig 2:- Benefits of Probiotics

Table 5:- Marketed Products of Probiotics [3]

Branded Name	Food type	Source	Manufacturing Company
Aciforce	Freeze product	dried Lactococcuslactis, Lactobacillus acidophilus, Bifidobacterium bifidum [44].	Biohorma, Netherland
Bactisaptil	Freez product	dried Bacillus strain spp. IP 5832	Sntgelbo, Belgium
Actimel	Probiotic yoghurt drink	Lactobacillus caseulimmunitas[11]	Danon ,France
Yajult	Milk drink	Lactobacillus casei Shirota[44] 11].	Yakult,Japan
Hellus	Dairy products	Lactobacillus fermentum ME-3	Talkinapiimatoostuse AS, Estinia

**3) Nutraceutical Enzymes:-**

Enzymes are the important part of body without enzymes body stop their functions and activities. Enzymes are the biocatalysts, that increases the metabolic rate of biological processes. Structurally enzymes are proteins in nature mainly obtained from the cell of plants microorganism and animal [5] [25] [28].

Table 6:- Nutraceutical Enzymes [3]

Microbial source	Plant source	Animal source
Catalade	Hemicellulase	Glucomylase
AminoglucoSidase	Pectinase	Biodiastase
Glucoamylase	Alpha Galactosidase	Beta amylase
Invertase [3]	Bromelain	Alpha galactosidase

**Uses:-**

- 1) Enzymes supplement can be used in the treatment of GERD, constipation, diarrhea, Ulcerative colitis, etc.
- 2) Now a day enzyme therapy uses in several rare diseases Gaucher disease, Pome disease, Fabry disease.
- 3) The regular use of nutraceutical enzymes in the diet and in medical condition like hypoglycemia, blood sugar problem, digestive disorder and obesity for reduction of its symptoms

**B) Nontraditional Nutraceuticals:-**

Nontraditional nutraceuticals are biotechnologically designed crops or food for boosting the nutrients or food enriched with the supplement. The food and crop contain biologically active components that will be biotechnologically engineered for human health improvement [5, 28].

E.g. Rice, Beta carotene, Btocoli vitamins

**1) Fortified nutraceutical:-**

Fortified nutraceutical nothing but a combination product of biotechnologically engineered crop or food (agricultural breeding) which contains bioactive components with main ingredients or nutrients [28]

E.g. minerals or vitamins added to cereals, Flour fortified with calcium, iron, and Folic acid

Milk is mixed with cholecalciferol for treatment of vitamin D deficiency [5].

**2) Recombinant nutraceutical:-**

These are the nutraceutical can be prepared by biotechnologically approved processes i.e. recombinant gene technology and fermentation in certain cases only [5, 28]

E.g. Bread, Yoghurt, Cheez, vinegar, etc.

Table 7:- Recombinant Plants and their use [3].

Recombinant plants	Deficiency	Gene for recombination
Golden Mustard	Vitamin A	Soya bean ferritin gene
Tomatoes	Folate	Aminodeoxychorismate
Golden rice	Vitamin A	Two daffodil genes and one bacterial gene

Table 8:- Recombinant Animals sources [3]

Recombinant Animal	Deficiency	Gene for recombination
Cattle	Human lysozyme	rHLZ expression vectorpBC2-HLY-NEOR
Cows	Lactoferrin deficiency	Recombinant human lactoferrin (rhlf)

## Recent Trends in Industry:-

- 1) All things about cannabis
- 2) Nutricosmetics
- 3) Supplements for pets
- 4) Plastic packing problem
- 5) Niche sport nutrition
- 6) Trend in online marketing of Nutraceutical

### 1) All things about cannabis:-

It is surprising news about cannabis there was a passing cannabis act 2018. It gives legality for in farming or cultivation of hemp or marijuana and their drive product in the US. Cannabidiol is the active ingredient that is derived from cannabis or hemp which is used in nutraceuticals [7, 70].



Fig; 3: Cannabis

As per US FDA CBD is an active constituent of cannabis. In 2018 the cannabidiol tincture nutraceutical market is growing with a revenue share of 42.6% because of increasing acceptance CBD for human being wellness CBD provides health benefits and human wellness without any psychological effects and also used active ingredients in epilepsy [64].

But one of the statement given by the FDA is CBD not be used in food supplements and beverages. The cannabis food product is legal in some states, but they have certain limits on it (How much quantity they can use) and the market for such a state is blooming [64]. Due to the benefits of the CBD and public awareness about cannabidiol the market was growing [63].

According to the report of Grand View Research the cannabidiol is used nutraceutical, the market was growing all over the world to exhibit a CAGR of 18.8% during the forecast period. The global value is assumed is \$7.7 billion in 2017. It reaches up to \$17.4 billion in 2020 and has been reached USD \$34.1 billion in 2021 [63].

### 2) Nutricosmetics:-

The term nutricosmetics is defined as natural skincare or health care products that improve the appearance and function of human hair, nails, and mainly the skin [61].The naturally occurring ingredients used in the nutricosmetic for beautification and personal for hygiene benefits [8].

Nutricosmetic is supplements used for maintenance and in improving the appearance of the skin and overall beauty of the body [8].

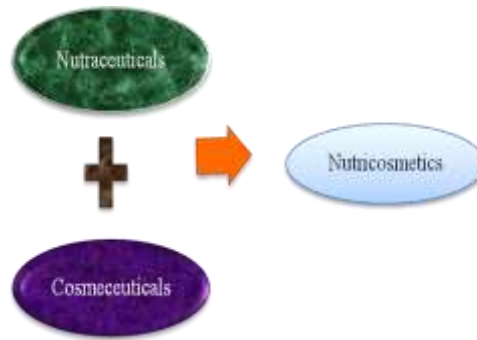


Fig 4:-Nutricosmetics

It is one of the most emerging trends in the nutraceutical products industry. The industrial value of the nutricosmetic is increasing year by year. This is because our next generation is crazy about beauty and personality, therefore they used chemical cosmetics, but in recent years study on cosmetics is found that they have many side effects on the skin like skin dryness, the blackness of skin, aging signs by their overuse [61, 68].

Then they give preference to the naturally occurring ingredients because they didn't have any side effect and 100% natural. The ingredient used in nutricosmetic are vitamin C, Vitamin K,  $\beta$  carotene, polypodiumleucolomes, polyphenol, various herbal extracts (Neem, aloe vera, etc) [8].

The popularity of nutricosmetics in men and women is unexpectedly increases. One study found that about 84% of men age 18-44 use nutricosmetic and skincare products [61, 64].

The other concept emerging in nutricosmetic is nutricosmetcis food and beverages [67]. It is a simple concept in which some ingredients that have medical and beauty benefits are added in supplements e.g. snaks bar, bakery products, fortified food. Fortified beverages contain fortified coffee, herbal tea, etc. These are products that contain are vitamins, minerals, herbal ingredients [8, 12].

The other trend is related to collagen. The demand for collagen is high throughout the period in industry, but some of the consumers are vegan, they look for alternatives to collagen. Some of the other non-animal sources used for nutricosmetic [12].

E.g. Bamboo, silica, gooseberry extract, etc.

The global market of nutricosmetics is growing because of the factors like increasinf consumer awareness about the personal care and give the performance of grooming and healthy lifestyle [61]. As per the report the global nutricosmetic market is USD 4.73 billion in 2016 and 2019 is USD 121 billion and it' goes up to USD 179 billion in 2022, which increase about by 50%. [61]

### 3) Supplements for Pets:

In today's world man considers pets as family members, therefore for their health and treatment, well growth they used pet nutraceutical, and the popularity of pet supplements is increasing [56]. The pet supplement mainly consists of vitamins and minerals for the growth of pets [54]. The owner of the pets is not only feeding them but also take care of the health of pets [64].

A study conducted by the American pet product association (APPA), under national pet owner survey, it is found that 76 million people in the US have one or two pets in their homes in 2018-19 [52].

When we come for pet supplement and pet food, the pet owner thinks the food is natural, contain organic ingredients and free from genetically modified cells & organs. Thus, these food supplements are safe and beneficial for pet health and reduce the risk of giving the contaminated products to pets [57]. This is a fact about the pet owner that especially purchases natural and organic supplements [51].



As per the report market control, it will find out that most of the younger people adopt the pet. It is another good factor for nutraceutical companies and pets [57, 58]. The owner of the pet is very conscious about the health of pets [51]. Therefore, they buy supplementary nutraceutical products for pets at the highest prices or the younger owner is more likely to spend an excessive amount of money on food for the pet's health [57].

The popular pet supplements and food products in the form of biscuits, soft chews, powder, liquid, Paste, and these forms make competition each other in the nutraceutical supplement market industry [50, 51]. The regulation related to the pet supplements is less as compared to the pets pharmaceutical. Therefore, it is an opportunity for the nutraceutical industry for pet supplements. For this reason, global market size increase pet nutraceutical [57].

According to market research, the global pet supplement sale is about USD 230 billion with CAGR of 3.5% in 2015-16 [51], in 2018 USD 580 billion. The pet nutraceutical market is growing CAGR 6.34 % and its value is USD 8.25 billion by 2023 as per the report of market research [55].

#### **4) Plastic packaging Problems:-**

The packaging of nutraceutical products is important because of the protection of the inner content, their freshness, and potency should be maintained. It is also important because to avoiding contamination and oxidation of the product [1, 74].

The various designs can make a positive impact on the consumer's mind for buying nutraceutical products and nutricosmetics e.g. UK based sports nutrition companies increased 300 % profit after a dramatic design of packaging [59].

The material used in packaging is plastic, glass, paper, metal, etc [1,6]. The plastic material has a negative impact on the environment or people. The material used other than plastic is sustainable and create a positive impact on the environment and people's [1] [60]

The packing material for nutraceuticals should be sustainable and environmentally friendly, but the nutraceutical companies used plastic for packing. The plastic material is sometimes not comfortable with the nutraceutical product hence it isn't eco-friendly [2]. The most important factor in this trends recycling and reusing packing material. The various nutraceutical companies can change their attributes about plastic packing and find out alternative ways to packing made themselves greener [60, 62].

The alternative for plastic is cardboard to play the role of plastic in packing [62]. The compostable packing gaining popularity for nutraceutical products selling in public and consumers appreciate and accept the product [74]. Another alternative to plastic is a seaweed-based sauce packet that replaces plastic [1].

To keep environmental safety in mind and long-term effect of packaging material led to the inclination of manufacturers towards sustainable packaging by adopting green packaging solution [64]. It switched from plastic to paper is a major trend in the nutraceutical product packaging industry [2, 62].

The global market of nutraceutical packaging in 2018 is USD 2.78 billion, report analysis is estimated to cross USD 4.2 billion in 2027 and the CAGR is 4.8% over the forecast period time i.e. 2019-27 [74] and in 2029 near about USD 5 billion [53].

#### **5) Sports nutrition supplements:-**

The megatrend highlighted in 20th century is growing market of sport nutrition supplements with other sectors like energy, workplaces, and weight management (basically find in most of the woman's)

The sports nutrition supplement mainly consists of protein powder, vitamins, a branched chain of amino acids, probiotics, omega 3 fatty acids, etc for boosting energy and make strong immunity power [22].

The athletics and bodybuilders are very caring about their fitness, health, and disease-free life. They daily consume the nutraceutical supplements for gaining energy, and strong muscular body and to increase the disease-resistant capacity [22].

The highest consuming nutraceutical supplements in athletics are proteins. There are various forms used for delivering the nutritional supplement such as powder, protein bar, shakes, beverages, fortified cookies, chews, gums, and these forms have different importance according to that time they use [21].

Another consumer group for sports nutrition supplements is women, according to research, 63% of woman's have looked for their general health improvement and wellness, and 45% attempt the healthiest diet plans with nutritional supplements[73]. This is because women give priority to their weight management, strong bone and muscle strength, and a healthy fit lifestyle [64].

Another factor is for the growing sport nutraceutical market is, increasing the number of gym and health club centers in the overall globe. The participation of people in fitness-related sport increases significantly. According to the report of 'Physical Activity Council' in 2018, 64% US population of age over six are engaged with sports activity [72].

The global sport nutraceutical market value is USD 15.6 billion, with CGAR 3.9% over the forecast period of time and it is expected to reach USD 31 billion by 2027 CAGR 8.9% over the forecasts period of time [68,72]

#### **.6) Trend in online marketing of Nutraceutical:-**

The global market of nutraceutical products in recent years is shifting from shops, malls to laptops, mobiles to buying nutraceutical products which create large or more opportunities for growing nutraceutical market dynamically

The online marketing of nutraceutical supplements through email, android apps, social media (Facebook, Instagram, and Twitter), television, youtube, etc. for directly communication with the consumer. The nutraceutical company also enhances brand awareness through the above things [71]. The customer also visits the various websites, blogs for collecting information about health related queries and product related to their health queries and problems, also checks products quality by seeing the public review of the product by different sources of internet.

The manufacture has been creating their blogs on the internet and website for the marketing of products. The manufacturer-provided all the necessary information about the regular health problems of peoples and how their product is beneficial for them. The manufacturer creates the need for their product by telling the people about the future problem of health. This is a psychological strategy that impacts on people.

By the proper design of the product and proper labeling is creates a firstly positive impact on the consumer mind. Therefore nutraceutical products have attractive label designs and they build up their product as a brand in the market for popularity.

These are the few basic strategies for online marketing of nutraceutical supplements such as Website, Email [71], Paid advertisement, Affiliate marketing, Amazon paid promotion.

For the modern business of nutraceutical supplement products, the companies have their separate website which gives all information about the company and products manufactured by the company. Email marketing is also another strategy for product marketing. According to research, 46% of people open their mail on mobile. Therefore, it is a more beneficial opportunity for nutraceutical supplement marketing.

The paid advertisements give much more needed visibility to the product. Advertises directly target customers according to their interest. It helps to reach product information to each & every person.

Affiliate Marketing is an emerging trend in the nutraceutical industry. It is a third-party publisher, which helps to the company for marketing the product all over the world. It is also taking the feedback of the product from consumer and analyses the requirements of the people and give the needed visibility to product.

Amazon paid promotion it is one the strategy for online marketing of nutraceutical. Online shopping on amazon is increasing significantly in recent years. Amazon showcases products and also gives

dedicated space for nutraceutical product and helping to a company to get in front of millions of peoples and buyers.

As per the research report of Euromonitor international, the global nutraceutical supplements market is growing worth USD 68 billion with online selling. The online sale of a product in the US has grown by 15.8% in 2017 and the total estimate is about USD 45.3billion & expected to reach USD 56.7billion in 2024.

The global dietary nutraceutical supplement market is expected to reach USD 210.3 billion in the year 2020 CGAR 6.4%.

### **Types of the delivery system of nutraceuticals:-**

#### **1) Nanoemulsion:-**

Nanoemulsion is a homogeneous, biphasic, thermodynamically stable system composed of the dispersed phase (inner phase) and dispersion phase (continuous phase or outer phase). i.e oil phase dispersed in aqueous phase vice versa [18, 42]. These are the emulsion which has extremely small nano-sized particles and appeared as transparent and translucent appearance. [69] (Particle size is 50-200nm) [18, 46].

Nanoemulsion is one of the best options for poorly water-soluble bioactive constituents. Most of the nutritional ingredients are lipophilic in nature therefore they easily incorporated into nanoemulsion [43].

The entrapment of such bioactive constituent in nanoemulsion has a very small size therefore they have a greater particle size area, thereby increasing the absorption rate and epithelial cell permeability, [43] then the therapeutic effect and bioavailability of nutritional constituent increases spontaneously [39].

The other advantage of nanoemulsion is they protect the bioactive constituents from oxidation, thereby, increase the stability and decreases the degradation of bioactive constituents from the gastrointestinal environment [45].

#### **2) Liposomes:-**

Liposomes are the type of lipid-based drug delivery system. It is defined as a spherical, bilayer vesicle made up of phospholipid and surfactant. The ideal size of liposomes is 100-400nm [41][66].

Liposomes are investigated as a potential drug delivery system because of their higher biocompatibility and the other advantage is both hydrophilic and hydrophobic types of active constituents can be delivered by liposomes [41].

The Liposomes are mainly composed of phospholipid (lecithin). The phospholipid has a head and tail-like structure i.e. hydrophilic head and lipophilic tail. In bilayer vesicle structure, a hydrophilic head faces the hydrophilic environment and a hydrophobic tail faces hydrophobic tail [41]. The lipophilic nutrients are incorporated in the lipophilic or hydrophobic region and hydrophilic nutrients are incorporated in the hydrophilic region i.e. central vesicle of liposomes [40].

The nutritionally active constituents are incorporated into the vesicle of liposomes and the hydrophilic and hydrophobic bioactive constituents are delivered from it [43].

Liposomes are advantageous as compared to the other dosage form because of high biocompatibility and absorption rate, i.e. deep intracellular delivery of the nutrients. Liposomes avoid the pain associated with the injection [38, 41].

#### **3) Probiotics:-**

The microorganisms which are beneficial for human, that can alter the gastrointestinal microbial flora and give and give beneficial effect by maximum absorption of nutrients to the host [9, 44].

The probiotic microorganisms can be delivered through the various types of vehicle such as they incorporated in the gel, capsule, suspension, emulsion using various techniques such as spray drying, extrusion, encapsulation, etc [9].

The emulsion is used for the encapsulation of the lactic acid bacteria. In this process, the probiotic cell and polymer solution is emulsified with dispersion or continuous or outer phase (e.g. sunflower oil, soy oil) [44].

Microparticles of probiotic microorganism's cell can be prepared by spray drying technology. In this process probiotic cell is dissolved in a polymer matrix and sprayed through the nozzle, then after spraying the droplets are drying in an evaporation chamber and uniform size microparticles are formed [27].

#### **4) Phytosomes - (Phyto- plants, Somes- cell like)**

Phytosomes are the type of phospholipid delivery system and are defined as "complex spherical, vesicles like structure made up of phospholipid in which plant extract or water-soluble phytoconstituents or bioactive constituents are incorporated in vesicles and provide lipid compatible molecular complex" [15].

Phytosomes enhance the absorption and bioavailability of bioactive constituents. It is able to transfer across the lipid bilayer i.e from the hydrophilic to the lipophilic region in the body. Thus the therapeutic effect of nutrients and Phytoconstituents is increased [15].

Different herbal extracts which consists of flavonoids, carotenoids, terpenoids, are delivered by the phytosomes. One of the advantages of phytosomes is they are more stable than liposomes and increase the nutritional value of herbal extract by enhancing permeability across the membrane. Therefore the market demand of phytosomes is higher [15].

#### **5) Nanoparticle:-**

Nanoparticle is extremely small, spherical particle which a size less than 100nm. There are various types of nanoparticle like a lipid-based nanoparticle and Polysaccharides-based nanoparticle [69].

The polysaccharides-based nanoparticles are used for both hydrophilic and hydrophobic components delivery. Due to the structural ability and site-specific action, they are acting as a carrier for nutraceuticals (nutrients) or targeted delivery system for nutraceutical [38].

Nanoparticles has good stability, high loading efficiency, and a controlled release mechanism for the release of bioactive constituents, therefore, they have a long-term effect and give maximum therapeutic effect [42].

The size of nanoparticles is very small therefore they show high permeability across the lipid bilayer (high absorption rate) and higher bioavailability of nutrients [38].

#### **6) Nanahydrogel:-**

Nanohydrogel is water-swallowable a cross-linked polymeric system which does not dissolve in water, i.e nanohydrogel is a network of cross-linked polymers. Nanohydrogel has three-dimensional complex structures have the large surface area, and hydrophilic nanosized structure or network. The structure of nanohydrogel is controlling the release of bioactive ingredients or nutrient, hence they increase the bioavailability of nutrients [47].

The nanohydrogel has the highest loading capacity and it improves the therapeutic efficacy by controlled, sustained, and targeted delivery of nutrients [49]. Both hydrophilic and hydrophobic nutrients have been delivered by it. The nanohydrogel plays a dual role of nanogel and nanoparticles. One of the benefits of nanohydrogel is biodegradable in nature, therefore they are nontoxic in nature. [47]

The nanohydrogel is formed by various techniques like emulsion polymerization technique, reverse micellar method, membrane emulsification, photographic technique, and micro molding method, etc [48].

### Conclusion:-

In this review, we extensively discussed about the need of nutrients to the human beings to boost the immune power and the nutrients from different natural sources such as plant probiotics and prebiotics and biotechnological derived food. The recent emerging trends in the nutraceutical industry is all things about cannabis, nutricosmetics, supplements for pets, plastic packing problem, sport nutrition supplements, a trends in online marketing of Nutraceutical and because of this trends, the market of nutraceutical is grown up year by year. The cannabis is tried to use as a nutrition source in minimum quantity. The use of nutrients in nutricosmetics is a fastest grown field in industry and the requirements of pet supplements are also increases. The plastic packing problem is common in nutraceuticals, so the industrial expert finding an alternative to plastic and developing green environment. The demand for sport nutrition supplements are increasing day by day therefore it is an important trend to grow the nutraceuticals market. The marketing of nutraceutical products by different tools are emails, android apps, social media, television advertisements, etc is also increases the nutraceutical market all over the globe. The recent carry out on the delivery systems for nutrients such as nanoemulsion, liposomes, probiotics food, phytosomes, nanoparticles, nanohydrogel to increase the bioavailability of nutrients.

### Abbreviation

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