

A REVIEW ON THE CLASSIFICATION, PREPARATION OF NUTRACEUTICALS AND THEIR APPLICATION

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ABSTRACT

Nutritional health products are a powerful tool for maintaining and improving human health. They can fight against acute and chronic diseases caused by nutrition deficiency that promote quality effectiveness of human life. Nutritional therapeutic properties are needed to improve human health but due to their poor bioavailability and depending on their chemical instability to pH, oxygen, temperature and absorption of food ingredients, and also their low intake and low gastrointestinal absorption, the nutritional health benefits still lag behind their potential. Some of these limitations can be resolved by using micron and nanocapsulation technologies that can provide new delivery systems to many food industry, enriching foods and beverages with nutraceuticals. Micron and nanoencapsules of nutritional products provide large variety of advantages related to their stability like thermal, pH, in vitro performance, improved bioavailability and biological activity. Nanocarriers like liposomes, Nanoemulsion, lipids and polymer nanoparticles, micelles and cyclodextrins complex used for the administration of nutritional products.

Key words: Nutraceuticals, Preparation, Mechanism, Health related improvement.

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INTRODUCTION

With the advancement of economy, income, expenditure and quality of life, everything improved. However, it also represents a wide challenge in the form of "disease lifestyle". The change in lifestyle is the first victim in dietary habits of life style. Fast-food consumption has increased in many ways, resulting in diseases related to undernourishment. Food supplements play an important role for the management of various disease. Therefore, more people are going towards dietary supplements for the recovery of disease [1].

Nutraceuticals term was created in 1989 by nutrition and medicine and was founded by "Stephen Defelice" founder and chairman of the Medical Innovation Foundation, which encourages health care. According to "nutraceuticals" is meant any

portion of food or food that provides therapeutic and health benefits, that's includes the prevention and treatment of the disease. "The range of these products can from isolated from nutrients, dietary supplements and specific diets by genetic engineering of foods and herbal products. The UK and France in the UK survey can see the concept of nutritional supplements and conclude that consumers are Sports or genetic factors have higher ratings to achieve good health. In the United States, "nutraceuticals" are usually used but there is no defined definition. The Canadian Ministry of Health revised its meaning to define nutritional products as "from foods." Products that are isolated or purified are usually sold in a food-independent medical form and show that it also has physical benefits. It also helps prevent chronic

diseases. "In the UK, the Ministry of Agriculture, Fisheries and Foods defines functional foods are "foods containing ingredients that can provide specific medical services." Or a physiological benefit, not a pure nutritional benefit" [2].

There is little difference between functional foods and nutrients. When using "scientific information" to cook or prepare food, or not knowing how or why to use it, the food is called "functional food." Therefore, functional foods provide the body with the vitamins, fats, proteins, and by carbohydrates needed for survival of human healthy life. When a functional food aids in the prevention and treatment of diseases. Diseases other than anemia, it is referred to as a nutritional food. For examples of nutritional products include fortified dairy products such as milk and citrus fruits such as orange juice.

Dietary supplements formally define by DSHEA using following criteria. Dietary supplements are the products that contain one or more supplements of the following dietary ingredients that increase the total daily intake (excluding tobacco) - vitamins, minerals, and herbs or other botanical ingredients, amino acids, or dietary diets. Dosage or concentration, metabolites, ingredients, extracts or a combination of these ingredients to supplement the diet. Take pills, capsules, tablets or liquids. It does not represent the sole purpose of traditional food or meals or diet. These labels are used as dietary supplements [2].

TYPES OF NUTRACEUTICALS

These are of following types

Antioxidants

Compound retarding or preventing the oxidation, Prolong the life of oxidizable matter, Eggs of naturally occurring antioxidants are glutathione and its precursors, vitamin E, iron and selenium [3].

Poly Unsaturated Fatty Acids

Pufaomega 6 reduced cholesterol formation for example flex seed and canola omega 3 reduced thromboxane formation example cod, salmon, tuna, sardines.

Probiotics

Living microorganisms taken with or without food. Improve intestinal microbial balance Help functioning of large probiotics intestine. Present in sour milk and yoghurts, e.g. Lactobacillus acidophilus. Nutraceuticals which promote the flourishing of probiotics. Food substances reaching the colon in intact form. Best known prebiotic inulin found in chicory [3].

Dietary Fibers

A dietary supplement is a dosage form version of the nutrients found in foods and are taken as an addition, or "supplement," to the daily diet. These supplements could take by different forms like tablet, capsules or liquid form, vitamins, minerals, herbs, botanicals, amino acids are all forms of dietary supplements. Examples of dietary fiber foods includes split peas, lentils, black beans, lima beans, and peas

Functional Foods

Usually used to refer to nutritional drugs. Closely related foods not drug no treatment effect. The concept nutraceuticals introduced in Japan in 1991 was legally defined by "food for specific health uses" (FOSHU). Expected to have a specific impact on health. Allergens have been removed and add or remove scientific assessments. Declaration of licenses must require for the effectiveness on health benefits.

Many functional foods appearance is similar to traditional foods and consumed as part of daily

conventional food with specific medical and physiological benefits.

Orally or orally administered foods formulated under the supervision of a doctor for the management of specific diseases are also affected by the unique nutritional requirements mostly depends upon the scientific principle. Functional foods include fatty fish, fortified margarines, oats, omega-3 enriched eggs, and nuts[4].

Dietary Supplement

In US, Dietary supplement is defined as a product that is intended to supplement the diet. hormones DHEA, pregnenolone and melatonin should contain any minerals, vitamin and, herbs or other plants (excluding tobacco) and amino acids, concentrates, metabolites, ingredients, extracts or a combination of any of the above must be used in pills, capsules, tablets, powder or liquid form The only item marked for use as a regular food as a meal is marked as a dietary supplement [5].

PREPARATION OF NUTRACEUTICALS

Following techniques are used for the preparation of nutraceuticals

Nano Dispersion by Emulsification

Emulsification is one of the most important steps for the microencapsulation process due to its microencapsulation efficiency and stable final product. Emulsification has traditionally been achieved by high shear homogenization. However, different new emulsification techniques also have been tested in microencapsulation of different core materials, such as microfluidization and sonication. However, only a few studies have used omega-3 rich vegetable oils. Our team compared high shear homogenization (19,000 rpm 9 minutes) and sonication (150 W power 60 s) and tested the microencapsulation efficiency of six different wall

material combinations and granularity. The results show the efficiency of microencapsulation under ultrasound is generally improved; in both combinations, different emulsification techniques are used to achieve similar efficiencies. Similarly, a smaller emulsion particle size of emulsion obtained by ultrasound in addition to the combination of wall materials using HiCap 100 and whey protein concentrate. In addition, by emulsification method the yield of product not affected. In the emulsification process, the particle size can be increase by providing more energy. Due to the slow adsorption speed of the surfactant, the residence time of the emulsion of the emulsification zone is short, the coalescence rate is high, and the energy density is extremely high. This phenomenon is called over-processing. Therefore, emulsification process of load energy and duration of emulsification must be optimized in microencapsulation [6].

Extraction Method

In a 5gram groundwater plant (more, referred to as feedstock rm), all samples were extracted by providing a specific solution with a specific solution corresponding to the solvent. The extraction was performed in water bath (New Brunswick Scientific) at 160 rpm and a constant temperature. To achieve a false balance, long contact (2 hours) was applied prior to liquid phase sampling and analysis. In the case of kinetic experiments, some of the same mixture was extracted in parallel, sampled at each time, and analyzed at different times to determine changes in concentration over time [7].

Direct Mixing and Addition of Preservatives

Calcium propionate is made from propionic acid and calcium hydroxide under hygienic conditions. Calcium propionate prolonging the shelf-life of baked goods and inhibits broad-spectrum fungus and

rope-like bacteria. Compared to other preservatives, propionate has minimal effect on yeast and is therefore the preferred ingredient for yeast culture products and tortillas. In bread and rolls, the amount of calcium propionate is usually between 0.3% and 0.5%. The level of purity of commercial propionic acid esters varies widely, so it is best to always ask the supplier's actual level. Better results were obtained when Victory CaP was used with dilute acetic acid. In order to calcium propionate minimize the inhibitory effect, the baker may add preservative at mixing phase of the dough rather than the selection phase [8].

Encapsulation

The following are the physical packaging methods for nutritious foods. These methods are pot coating, air suspension coating, centrifugal extrusion, vibrating nozzles, spray drying, ionic gelation, condensed phase separation and interfacial polycondensation [9].

MECHANISM OF NUTRACEUTICALS

The 3rd International Conference on International Health Product Action Mechanisms (ICMAN 3) brought together researchers from around the world to find answers and share the role of nutraceuticals in human health and acute or chronic disease. Currently, the beneficial effects of dietary supplements on coronary heart disease, osteoporosis, cancer and other chronic and degenerative diseases such as diabetes, Parkinson's disease and Alzheimer's disease are being recognized. This has prompted the study of nutritional drugs mechanisms of action and drug related biologically active compounds pathological disease. There is ample evidence that the mechanical action of natural compounds involves a variety of biological process, including activation of antioxidant defense system, signal transduction pathways, cell

survival-related gene expression, cell proliferation, differentiation, and maintenance of mitochondrial integrity. In addition, many of nutritional compounds exert anti-inflammatory effects by inhibiting the oxidative stress-induced by transcription factors (eg, NF- κ B, AP-1), cytotoxic cytokines and cyclooxygenase-2. It seems that, these characteristics play an important role in preventing so many age-related and chronic diseases [11, 12].

ADVANTAGES OF NUTRACEUTICALS

Following are the advantages of nutraceuticals to improve human health, Delay aging, Increase level of life expectancy, that reduced side effects with high desirable outcomes, Holistic approaches, Food supplies being on a dwindling mode, Markets focusing on supply of highly processed foods lacking sufficient and appropriate nutrients, Media drawing people's attention to nutraceuticals, Baby boomers reaching golden ages[13].

LIMITATIONS

Mostly drugs and test method doesn't register from the regulatory authority, most of which are not regulated by the US and FDA. The company manufacture unregulated products to create a wide range of profitability, low bioavailability of nutrients, no regulatory definition, and its effect can be attributed to placebo [14].

APPLICATION OF NUTRACEUTICALS

Probiotic Nutraceuticals

Probiotics means "life" defined as living microorganisms that, when consumed enough, have health impact on the owner. Probiotic are friendly bacteria that promote digestion and absorption of many nutrients by modifying the microbial communities, they can prevent pathogens from adhering to intestinal epithelial cells compete with the nutrients that are important for pathogen, produce

Table 1: Nutraceutical products with active constituents and therapeutic uses. [10]

Product	Active Constituents	Therapeutics Class/Use
Coenzyme Q10 (240 soft gelatin capsule / 3535)	Ubiquinone	Ubiquinone is likely effective in alternative medicine as an aid in treating coenzyme Q-10 deficiency.
Omacor (28 capsule / 2163)	Omega-3 Polyunsaturated fatty acids	Omega-3 polyunsaturated fatty acids are obtained from oil certain types of fish, vegetables, and other plant sources. Used in combination with diet and exercise to help lower the level of triglyceride in blood.
Osteo Bi-Flex (80 capsule / 3200)	Chondroitin/Glucosamine	Chondroitin is naturally occurring substance formed chains of sugar. Chondroitin maintain body fluid and flexibility in the joints. Osteo Bi-Flex used in combination of other product that has been used in alternative medicine as a possibly effective aid in treating osteoarthritis pain.
Melatonin Time Release (60 capsule / 1100)	Melatonin	Melatonin time release is a manmade form of hormone that produced in the brain and helps to regulate your sleep and wake cycle. It also used as alternative medicine that provide effective aid in treating insomnia
L-Carnitine (30 capsule / 2295)	Levocarnitine	Levocarnitine is naturally occurred substance that's needs for body energy. Levocarnitine is also used for the treatment of carnitine deficiency.
Cosamin DS (30 soft gels / 150)	Chondroitin/glucosamine	Chondroitin is help to maintain body fluid and flexibility in the joints and glucosamine is sugar protein that helps body to build cartilage.
Alpha-Lipoic Acid-300 (120 tablet / 3562)	Alpha-lipoic acid	Alpha-lipoic acid is an antioxidant also called Acetate Replacing Factor. Alpha-lipoic acid also has been used to treat rheumatoid arthritis, Alzheimer's disease, liver problems caused by alcohol, altitude sickness, heart related nerve problem, HIV related brain problems and eye problems caused by diabetes.
Aminomine (30 capsule / 1110)	Tryptophan	L-tryptophan used with other medicines to treat mental depression. L-tryptophan also used with combination of lithium to treat bipolar disorder.
Cystadane (Pack / 816)	Betaine	Cystadane works by preventing the build-up of an amino acid called homocysteine. Cystadane is used to reduce homocysteine levels
Dry Eye Omega (Pack / 400)	Omega-3 polyunsaturated fatty acids	It is natural triglyceride form, combined with Vitamin D3 (cholecalciferol). Dry Eye Omega Benefits is a solution used for those who suffered in eye dryness, scratchy, red, or irritated eyes, Dry Eye Omega is formulated with a high concentration of the anti-inflammatory Omega-3 and EPA (eicosapentaenoic acid) in its natural triglyceride form, combined with Vitamin D3 (cholecalciferol) for additional health benefits. This product offers an effective, safe, and natural way to recover dry eye symptoms systemically than topically.

antitoxin effects and reverse some of the consequences of intestinal epithelial infections, such as secretory changes and neutrophil translocation. Probiotics can treat lactose intolerance by producing a specific enzyme (β -galactosidase) capable of hydrolyzing aggressive lactose into its constituents. Enflor is the first probiotic that Hilton launched in Pakistan. It is *Saccharomyces boulardii*, and a bag of Enflor contains about 5 billion living cells [15].

Cardiovascular Diseases and Nutraceuticals

Molecules, for example, polyphenols change cell metabolism and signals to reduce arterial disease. Flavonoids block an enzyme converting enzyme, block cyclooxygenase, prevent platelet aggregation and decompose prostaglandins. Oxygen and nutrients also protect the vascular system infiltrates the cell. Orange juice, the pulp is rich in flavonoids. Hesperidin is a flavonoid glycoside, classified as a bioflavonoid of citrus fruits. Lemon peels and orange peels and membranes have the highest concentration of hesperidin. Hesperidin is not enough to treat illness and hemorrhoids [16].

Cancer and Nutraceuticals

The group of phytochemicals are carotenoids, that are mostly responsible for different foods of colors that

have antioxidant activity and effective for preventing cancer. The latest interest of carotenoids mainly focused on human sludge in health of human, particularly tumor. Due to its unstable nature of lycopene effective antibodies and oxygen [17].

Diabetes and Nutraceuticals

An antioxidant lipoic acid used to treat diabetic neuropathy, Diabetic complications can be recovered by use of long term dietary supplement [18].

Eye Disorders and Nutraceuticals

For the treatment of visual impairment lutein and zeaxanthin are used. Marigold flower contains about 86% of carotenoid zeaxanthin and lutein [19].

Parkinson's Disease and Nutraceuticals

Vitamin E, Glutathione, Creatine seems to have a protective effect on Parkinson's disease [20].

CONCLUSION

By the use of different modern manufacturing techniques like emulsification, extraction, addition of preservative and encapsulation of foods that's are enrich with nutritious moiety enhance the absorption of nutritional diet and efficacy also encourage the human to attract the nutritional diet that have therapeutic effects with minimum adverse effect.

REFERENCES

1. Barros L, Heleno S, Carvalho A, Ferreira I. Systematic evaluation of the antioxidant potential of different parts of *Foeniculum vulgare* Mill. from Portugal, *Food and Chemical Toxicology*, 47, 24-58, 2009.
2. Chauhan B, Kumar G, Kalam N, Ansari SH. Current concepts and prospects of herbal nutraceutical: A review. *Journal of Advance Pharmaceutical Technology Res*, 4, 4-8, 2013.
3. Brand-Williams W, Cuvelier ME, Berset C. Use of a free radical method to evaluate antioxidant activity, *Methods used to evaluate the free radical scavenging activity in foods and biological systems. Food Science and Technology Intern*, 8 121, 2002.
4. Hardy G. Nutraceuticals and functional foods: introduction and meaning. *Nutrition*, 16 (7-8), 688-9, 2000.
5. Perez-Jimenez J, Arranz S, Taberner M, Diaz-Rubio M, Serrano J, Gono I, Saura-Calixto F. Updated methodology to determine antioxidant capacity in plant foods, oils and beverages: Extraction, measurement and expression of results, *Food Research Intern*, 41, 274, 2008.
6. Solans C, Izquierdo P, Nolla J, Azemar N, Garcia-Celma M. Nano-emulsions. *Current Opinion in Colloid & Interface Science*, 10(3-4), 102-110, 2005.
7. Brookes PC, Landman A, Pruden G, Jenkinson DS. Chloroform fumigation and the release of soil nitrogen: a rapid direct extraction method to measure microbial biomass nitrogen in soil. *Soil biology and biochemistry*, 17(6), 837-842, 1985.
8. Kepner RL, Pratt JR. Use of fluorochromes for direct enumeration of total bacteria in environmental samples: past and present. *Microbiological Reviews*, 58(4), 603-615, 1994.
9. Douglas T, Young M. Host-guest encapsulation of materials by assembled virus protein cages. *Nature*, 393(6681), 152, 1998.
10. <https://www.drugs.com/drug-class/nutraceutical-products.html>. dated April 21, 2017.
11. Das L, Bhaumik E, Raychaudhuri U, Chakraborty R. Role of nutraceuticals in human health. *Journal of Food Science and Technology*, 49(2), 173-183, 2012.

12. Mandel S, Packer L, Youdim MB, Weinreb O. Proceedings from the "Third International Conference on mechanism of Action of Nutraceuticals". *The Journal of nutritional biochemistry*, 16(9), 513-520, 2005.
13. Kalra EK. Nutraceutical-definition and introduction. *Pharmaceutical sciences*, 5(3), 27-28, 2003.
14. Wildman Robert EC, *Handbook of Nutraceuticals and Functional Foods* (1st ed.). CRC Series in Modern Nutrition. ISBN 0-8493-8734-5, 2001.
15. Penner R, Fedorak RN, Madsen KL. Probiotics and nutraceuticals: non-medicinal treatments of gastrointestinal diseases. *Current opinion in pharmacology*, 5(6), 596-603, 2005.
16. Ramaa CS, Shirode AR, Mundada AS, Kadam VJ. Nutraceuticals-an emerging era in the treatment and prevention of cardiovascular diseases. *Current Pharmaceutical Biotechnology*, 7(1), 15-23, 2006.
17. Nair HB, Sung B, Yadav VR, Kannappan R, Chaturvedi MM, Aggarwal BB. Delivery of antiinflammatory nutraceuticals by nanoparticles for the prevention and treatment of cancer. *Biochemical Pharmacology*, 80(12), 1833-1843, 2010.
18. Bahadoran Z, Mirmiran P, Azizi F. Dietary polyphenols as potential nutraceuticals in management of diabetes: a review. *Journal of Diabetes & Metabolic Disorders*, 12(1), 43, 2013.
19. Ajibola A, Chamunorwa JP, Erlwanger KH. Nutraceutical values of natural honey and its contribution to human health and wealth. *Nutrition & Metabolism*, 9(1), 61, 2012.
20. Chao J, Leung Y, Wang M, Chang RC. Nutraceuticals and their preventive or potential therapeutic value in Parkinson's disease. *Nutrition Reviews*, 70(7), 373-386, 2012.