

Nutraceuticals and Its Impact on Healthcare

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Abstract- Hippocrates said "let food be your medicine and medicine be your food, to predict the relation between food for health and their scientific therapeutic benefits". In ayurveda the ancient science of medicine a lot of emphasis is given to role of nutrition in health and disease. The term nutraceuticals derived from nutrition and pharmaceuticals was coined 1989 by Dr. Stephen De Felis (chairman of the foundation for innovation in medicine.) Nutraceutical is any substance that may be considered as food or a part of food, which provides medical or health benefit and encompasses prevention and treatment of disease. Isolated nutrients, dietary supplement and diet to genetically engineered designer food, herbal product and processed product such as cereal, soup, and beverages may be included under the term umbrella of nutraceuticals. This is a rapidly growing industry with more than 100 million people using this nation product but as like drug there should be strict regulatory control for nutraceutical. The concept of nutraceutical is not entirely new although it has evolved considerably over years. In the early 1900s food manufacturers in the United States began adding iodine to salt in an effort to prevent goiter, representing one of the first attempts at creating a functional component through fortification. Researchers have identified 100 of compounds with functional qualities and they continue to make new discoveries surrounding the complex benefits of phytochemicals in food. In Japan, England and other countries nutraceuticals already have become part of the dietary landscape. Consumer interest in the relationship between diet and health has increased in demand for information on nutraceuticals.

Index terms- Nutraceuticals, Medicine, Health, Antioxidant, Phytochemicals, Disease

INTRODUCTION

DEFINITION OF NUTRACEUTICALS

The term "Nutraceuticals" combines the words "nutrient" and pharmaceutical (medical drug). Nutraceuticals are pharmaceutical grade and standardized nutrients. Nutraceuticals are regulated by



FDA. Under the authority of federal food, drug and cosmetic act

Classification of nutraceuticals: (therapeutically important compounds of the nutraceuticals products responsible for scientific health benefit can be done as given in table)

Class	Examples
Inorganic mineral supplements	Minerals (Ca, Mg, B, Cu, Zn etc)
Vitamins, supplements	Vitamins
Digestive enzyme	Enzymes
Probiotic	Lactobacillus acidophilus
Prebiotic	Digestive enzyme
Dietary fibres	Fibres
Cereals and grains	Fibres
Health drinks	Fibres
Antioxidant	Vitamin c, carotenoids, xanthophylls, flavonoids
Phytochemicals	Polysaccharides, isoprenoids, flavonoids

1) DIETARY FIBER

Dietary fiber (DF) consists of non-digestible carbohydrates and lignins that are intrinsic and intact in plants. Functional fiber (FF) consists of isolated, non-digestible carbohydrates that have beneficial physiological effects in humans. Total fiber is the sum of dietary and functional fiber.

2) PROBIOTICS:

Lactobacillus this may be the most common probiotic. It's the one you'll find in yogurt and other fermented foods. Different strains can help with diarrhea and may help with people who can't digest lactose, the sugar in milk.

3) ANTIOXIDANT:

Antioxidants damage to cells caused by free radicals is believed to play a central role in the ageing process and in disease progression. Antioxidants are our first line of defense against free radical damage, and are critical for maintaining optimum health and wellbeing. Oxygen is a highly reactive atom that is capable of becoming part of potentially damaging molecules commonly called "free radicals." Free radicals are capable of attacking the healthy cells of the body, causing them to lose their structure and function. Antioxidants are capable of stabilizing, or deactivating, free radicals before they attack cells. Antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well-being. Humans have evolved a highly sophisticated and complex antioxidant protection system. It involves a variety of components, both endogenous and exogenous in origin, that function interactively and synergistically to neutralize free radicals. These components include: Nutrient-derived antioxidants like ascorbic acid (vitamin C), tocopherols and tocotrienols (vitamin E), carotenoids, and other low molecular weight compounds such as glutathione and lipoic acid. Antioxidant enzymes, such as superoxide dismutase, glutathione peroxidase, and glutathione reductase, which catalyze free radical quenching reactions. Metal binding proteins, such as ferritin, lactoferrin, albumin, and ceruloplasmin that sequester free iron and copper ions that are capable of catalyzing oxidative reactions. Numerous other antioxidant phytonutrient spared.

4) PHYTOCHEMICALS:

Essential Phytochemicals are precious for human nutrition. Indoles, isothiocyanates, and sulforaphane from vegetables, such as broccoli, allylic sulfides from onions and garlic and isoflavonoids from soybeans are known as plant phytochemicals are in a wide variety of plant foods.

5) PREBIOTICS:

Prebiotics are non-digestible carbohydrates that serve as food for the beneficial bacteria present in the gut and aid in their growth.

MODE OF ACTION

Nutraceuticals function by increasing supply of important building blocks to body. The supply of this essential building block can be done two ways: reducing size of building blocks can be done by two ways

1. By reducing sign of the disease as buffering agent or relief.
2. By directly providing benefits for health of individuals.

ROLE OF NUTRACEUTICALS

1 DIABETES AND NUTRACEUTICALS

Most common form of diabetes is type 2 diabetes with 95% prevalence and associated with obesity. Although various drugs for prevention and treatment of diabetes have been introduced, however globally the total number of people with diabetes with various causes is increasing. Diabetes, not only imposes considerable economic burden on individual patient and their families but also places substantial economic burden on society. In recent years, wide range of herbal dietary supplements and herbal medicine have scientifically proven to benefit type 2 diabetes mellitus in preclinical studies, however, few have proven to do so in properly design randomized clinical trials. Flavones are phytochemicals which have structural/functional similarities to human estrogen. Soy isoflavones have been studied most and their consumption have been associated with lower incidence and mortality rate of type 2 diabetes, heart disease, osteoporosis and certain cancer. Omega-3 fatty acid have been suggested to reduce glucose tolerance in patient predisposed to diabetes. For the synthesis of long chain n-3 fatty acid, insulin is required the heart may thus be particularly susceptible to their depletion in diabetes. Ethyl ester of 3-fatty acid may be potential beneficial in diabetes patient.

2. CARDIOVASCULAR DISEASE AND NUTRACEUTICALS

CVD is a term which is used for disorders of heart and vessels and includes coronary heart disease, peripheral vascular disease, cerebrovascular disease (stroke), hypertension, heart failure etc. It is believed that low intake of vegetables and fruits are associated with mortality in CVD. Majority of the CVD are preventable. Many studies have reported a protective role for a diet rich in vegetable and fruit against CVD. Nutraceuticals in the form of vitamins, minerals, antioxidant, dietary fibres, and omega3-polyunsaturated fatty acids (n-3PUFAs) together with physical exercise are recommended for prevention and treatment of CVD. The molecule such as polyphenols alters cellular metabolism and signaling, which is believed to reduce arterial disease. Flavonoids intake was significantly inversely associated with mortality from coronary heart disease and incidence of myocardial infarction.

3. CANCER AND NEUTRACEUTICAL

Cancer has emerged as a major public problem in developing countries. A healthy life and diet can help in prevention of cancer. Carotenoids are the group of phytochemical responsible for the different colors of the foods. They have antioxidant properties and effective on cancer prevention. Lycopene contained vegetables and fruits exert cancer protective effect via a decrease in oxidative stress and damage to DNA. Chronic inflammation is associated with high risk of cancer. Chronic inflammation is also associated with immunosuppressant which is risk factor for cancer. Ginseng is an example of anti-inflammatory molecule that targets many of the key players in the inflammation to cancer sequence. Citrus fruit flavonoids are able to protect against cancer by acting as antioxidant. A broad range of phytopharmaceuticals with a claimed hormonal activity called "phytoestrogens" is recommended for prevention of prostate and breast cancer.

4. INFLAMMATORY BOWEL DISEASE AND NEUTRACEUTICALS

Inactive inflammatory bowel disease (IBD) and in experimental DSS-colitis have shown that dietary supplement such as probiotic, fishoil, curcumin, and aloe vera can ameliorate intestinal inflammation. Plant derived natural compound carry out their protective and therapeutic effect through different molecular pathway, including anti-inflammatory and

immunoregulatory mechanism, anti-oxidant properties and modulation of intracellular signaling transduction pathway. Curcumin and green tea supplementation have been reported to be effective in reducing both IBD symptomatology and inflammatory score.

CONDITIONS	NUTRACEUTICALS
Prostate support	tomato lycopenes
Immunomodulators	Ginseng
Female Hormone support	Black cohosh, false unicorn
Diabetic support	Garlic, momordica
Digestic support	Digestive enzymes
Cholesterol lowering	Garlic
Cardiac diseases	Garlic
Cancer prevention	Flax seeds, green tea
Arthritis support	Glucosamine
Allergy relief	Ginkgo biloba

GLUCOSAMINE AND CHONDROITIN

Glucosamine is a precursor to a molecule called a glycosaminoglycan-this molecule is used in the formation and repair of cartilage. Source-bovine or calf cartilage. Glucosamine sulphate in several European countries used as first line of treatment for arthritis. Their side effects and contraindications are less but diabetics need to be careful as glucosamine might have an effect on insulin resistance. Glucosamine sulphate stimulates the production of hyaluronic acid in joint fluid. Hyaluronic acid relieves pain and improves mobility by repairing particularly fermented milk products, or has been investigated with regard to their medicinal use. In vitro experiment of Glucosamine has shown a dose dependent increase in proteoglycan after administering it. It is marketed usually as hydrochloride or sulfate salt. Both compounds have anti-inflammatory effects.

ROLE OF RESEARCH AND DEVELOPMENT IN NUTRACEUTICALS

- To test safety, purity and potency of products.
- To develop more effective and efficient means of producing ingredients for use in products.

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

Scope of nutraceuticals

- To reduce antinutritional factors of feed components.
- To activate immunity.
- Growth promotion-promote substantial aquaculture production.
- Nutrition security to fishes and shellfishes and quality nutritional security for human population.
- Increased feed consumption.
- Induce maturation.
- Stress mitigation.
- Antimicrobial capability.
- No negative environmental impact and hazardous problems.

Why consumers choose alternative over conventional remedies?

- Many patients are not satisfied with the treatment they are given by their doctors due to adverse effects or because it has been ineffective.
- Another reason for choosing alternative over conventional remedies is that patients may feel that conventional medicine is impersonal or technologically orientated.
- Some patients prefer to have personal control over their healthcare and therefore are happier to self-select than be told what to take by their doctor.

CURRENT STATUS ABOUT NUTRACEUTICALS

Nutraceutical food or food components that help in treatment and prevention of diseases are made from herbal/botanical raw material. This is rapidly growing industry (7-12 % per year) with more than millions of people in the world using this natural products. The global nutraceutical market to reach \$ 450 billion by 2015. According to recent analysis from Euro monitor, international global sales of health and wellness products are on track to reach a record of about \$1 trillion by 2017, fueled by functional/fortified products designed to offer specific health benefits.

Nutraceuticals represent an exciting new opportunity for food and pharmaceutical companies to diversify		
	CHALLENGES	RELEVANCE OF NUTRACEUTICALS
PHARMA COMPANIES	<ul style="list-style-type: none"> ● Declining return on R&D investment ● 'Patent cliff' ● Pressures on health budgets ● Regulatory oversight 	<ul style="list-style-type: none"> ● New sector with lower R&D costs ● New revenue source ● Most purchases are by consumers ● Less onerous regulatory requirements
FOOD COMPANIES	<ul style="list-style-type: none"> ● Slow-growing ● Retailer-owned brands ● Retailer power ● Internet marketing 	<ul style="list-style-type: none"> ● Fast growing ● Source of differentiation & higher margins ● Innovative products increase bargaining power ● Accepted channel for new products

CONCLUSION

Nutraceuticals can provide substantial health benefits especially in the prevention and/or treatment of acute and chronic human diseases. But its development depends upon its quality, safety, long-term adverse effects, and toxicity as well as supplementation studies and clinical trials in humans. Attempts are made to avoid genetic disorders using nutraceuticals in form of enzymes, probiotics and fortified food. Commercial nutraceuticals have to pass through strict regulatory controls to provide a positive impact on an individual's health.

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