

# POTENTIALLY TO MEDICAL APPLIANCES THROUGH NUTRACEUTICAL STUDIES

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(Received 02<sup>nd</sup> February 2024; revised 13<sup>th</sup> April 2024; accepted 20<sup>th</sup> April 2024)

**Abstract.** Nutraceutical is any substance that is the food or a part of food and provides health benefits beyond basic nutrition. Because of its advantages and easily accessible human being are showing great preference shifting towards nutraceutical. Nowadays, people believe in the cure than prevention and especially for chronic disease most of allopathic medicines have no effective solution due to this people are preferring these item. It has various health benefits in animals such as in case of cardiovascular disease, joint disease, for control of ticks, fleas, and other ectoparasites. Different herbal plants, nutrients and various nutraceutical are used in treating of human and animal disease. It also has a big role in animal production mainly as a growth promoter. Nutraceuticals are classified in multiple way but in general it can be categorized as traditional and non traditional based on their availability in the market. Nutraceutical provide all the essential substances that should be present in a healthy diet for human and animals. Several chemical constituents from natural sources can be obtained and prepared into various improved, safe and stable formulations for the treatment and diagnosis of diseases. Nutraceutical are widely used in the food and pharmaceutical industries. Most of the nutraceutical are from mineral origin, animal origin or vegetable origin. Generally even if nutraceutical has various importance it also has some drawback like lack of awareness among most of people and in the processing and delivery of the products. In order to bring nutraceutical from bench to table and clinical application the society who use this item should be educated and recommended the way how to use the product for themselves and their animals. Giving awareness the advantage of nutraceutical in minimizing the drug resistance and side effect caused by allopathic medicines.

**Keywords:** *challenges, classification, health benefit, nutraceutical*

## Introduction

Stephen Defelice coined the term nutraceutical which was derived from the word Nutrition and Pharmaceuticals. Nutraceutical is a broad term used to describe any product derived from food sources that provide extra health benefits along with nutritional value found in foods. Nutraceutical is important in the veterinary field since it offers additional health benefits beyond basic nutrition. Correct supplementation provides a better quality of life and cures diseases with reduced side effects (Rohan et al., 2011). A nutraceutical may be a naturally nutrient rich food such as, garlic, soya bean or a specific component of a food like omega-3 oil from salmon. Nutreaceutical are also known as medical foods and nutritional supplements. It ranges from isolated nutrients, dietary supplements, genetically engineered designer foods, and herbal products. Nutreaceutical have received considerable interest because of its presumed safety and potential nutritional and therapeutic effects (Rajasekaran et al., 2008). Nowaday, a new diet health concept is evolving which places more emphasis on the positive aspects of diet. The new lifestyle adopted by people today has changed the basic food habits of the latter. Consumption of mal nutrition has increased diverse leading to several diseases caused due to improper nutrition. Consumers being frustrated with the expensive disease-treatment approach in modern medicines are seeking

complementary or alternative beneficial products and the red tape of managed care makes nutraceutical particularly attractive (Adelaja and Schilling, 1999).

These product are found to contain lipids, proteins, carbohydrates, vitamins, and other accessory nutrients in the required amounts (Whitman, 2001). The idea behind the curing mode of action of nutraceutical is to exhibit functional benefits with the supply of natural building blocks, in the body. With the replacement of these building blocks nutraceuticals can diminish disease symptoms and help cure those (Tank Dharti et al., 2010). Industrialization has caused numerous air and water pollutions, soil, and food contamination because of the extensive use of various chemicals, heavy metals, electromagnetic waves, and other potentially harmful man-made items. These problems have led to an increased incidence of diabetes, obesity, different cancers, and vascular diseases, physiological problems, as well as other degenerative diseases. The raised demands for health care have dramatically increased the cost of medical care. Therefore, people have tried to achieve a better quality of life by eating more vegetables, fruits, and other plant foods, taking dietary supplements or nutraceuticals, or using nutritional therapy to replace chemotherapy (Zhao, 2007). Therefore, the objectives of this review are: (1) to over view on general potential medical application of nutraceutical, and (2) to highlight the general concept of nutraceutical.

### ***History of nutraceuticals***

The ancient writings and artworks of Egyptians, Romans, and Greek civilizations illustrated the medicinal and spiritual applications of plants. The idea arose 3000 years ago BC when Hippocrates developed a relationship between food for health and therapeutic applications of it. The principal truth described in his statement that “Let food be thy medicine and medicine be thy food” is widely applied nowadays (Bagchi, 2014; Ahmad et al., 2013). Thus, from such finding, it could be believed that our nature and surroundings have much of the natural therapies to offer. One such finding presents the botanicals, which are in use from ancient times for the treatment of cancer. Similarly, there are many plant derived chemotherapies which consist of Vinca and Taxus brevifolia species to treat cancer and related problems. Furthermore, Ginseng has been another such traditional drug which is in use from past 2000 years in China. It was from the time of Liang dynasty of China that the chemotherapy features of ginseng were discovered and applied even in today’s time From the documented history, Egyptians identified the medicinal importance of coriander, fennel, juniper, cumin, garlic, turmeric, thyme, curry, and dried mint found in pyramids. The value of such medicinal sources was so high that even cinnamon was considered more precious in comparison to gold in Egypt (Viuda-Martos et al., 2008).

Due to the explored properties of plants, the Roman emperor Heliogabalus made use of cinnamon, clove, and pepper in meals which are used in cuisines and soft drinks until present time. In addition, there were many other plants and food additives identified such as honey and certain vitamins. Honey has always been given prime importance since ancient period. It was referred in Sumerians tablet writing as one of the remedies for health problems. According to Bible, the wise Solomon has said, “Eat honey, my son, because it is good”. With the illustration of properties possessed by honey, apitherapy has been developed as a separate medicinal branch related with medication properties provided by honey (Bogdanov, 2012). Another instance which explains the importance of the food and nutrients within is of the ancient crewmen. During the past few centuries, many crewmen on long voyages died of scurvy, the exploring facts

revealed the absence of Vitamins B and C in the diet acting as antiscorbutic which was later ensured to be the part of the diet. In the same way, Goiter was found as the common problem due to deficiency of iodine in salt. The health problems, thus, were identified and were dealt with the help of diet and healthy lifestyle; therefore, all these examples very clearly explain the requirement of a healthy diet and herbal components with the potential to serve the same (Shirwaikar et al., 2011).

One of the surveys in United Kingdom, Germany, and France has concluded that the diet has more profound effects for healthy body and mind than exercise or genetic factors. The above mentioned findings motivate and direct the research toward a rediscovery of nutrients as nutraceuticals. The researchers in past 20 years have concluded that the diet plays a key role in the prophylaxis of chronic disorders atherosclerosis and cancer. The credible success in isolation of food component had been achieved precisely with the help of proper clinical and laboratory investigations to verify the efficacy (Pandey et al., 2010).

## **Discussion**

### ***The reason for human to shift towards nutraceuticals***

Recently human beings are showing great preference for nutraceuticals due to various reasons. Among these, People believing more in prevention than a cure and have found no solution for themselves and their animal in allopathic medicines due to their so many drug resistance issues and various side effects. In addition to this many people who are economically challenged and dissatisfied with pharmaceutical agents in promoting health, are turning to nutraceuticals to improve their health. Nowadays health care provider recognizes the fact that our heavily processed food supply, coming from crops grown with chemical fertilizers, pesticides, herbicides, and often genetically modified seeds, lacks sufficient nutrients necessary for optimum health so to get better feed shifting towards nutraceuticals is the best option (Olaiya et al., 2016). Lifestyles of human beings have changed drastically due to the industrial age, increasing work, living speed, longer work schedules and various psychological pressures which have led to an increased incidence of diabetes, obesity, various cancers and vascular diseases. The major group of nutraceuticals is endogenous in origin, being natural products responsible for stimulating activity in healthy humans. Dietary nutraceuticals may be found in specific foods and be ingested e.g., soy isoflavones, alpha lipoic acid and carotenoids to name a few (McCarty, 2005).

### ***Classifications of nutraceuticals***

Depending upon its easier understanding and application Nutraceutical can be organized or classified into three broad categories, which are: (a) a substances with established nutritional functions, such as vitamins, minerals, amino acids, and fatty acids, also defined as nutrients; (b) herbs or botanical products as concentrates and extracts, often called herbals; and (c) reagents such as pyruvate, chondroitin sulfate, and steroid hormone precursors that are derived from other sources and serve specific functions, such as sports nutrition, weight-loss supplements, and meal replacements, also indicated as dietary supplements. It also nutraceutical classified based on their availability in market into Nontraditional nutraceutical, Traditional Nutraceutical, probiotics and prebiotics (Chauhan et al., 2013).

### ***Nontraditional nutraceutical***

These are artificial foods prepared with the aid of biotechnology. This class of nutraceutical is enhancing nutritional content by the addition of nutrients or dietary components for improvement of quality of nutrition. Beta carotene enriched rice is an example of this category (Sapkale et al., 2012). They are the outcome from agricultural breeding or added nutrients and/or ingredients such as orange juice fortified with calcium, cereals with added vitamins or minerals and flour with added folic acid are nontraditional nutraceutical (Maurya et al., 2021).

### ***Fortified nutraceutical***

Fortification of food components is the process of the addition of micronutrients (essential trace elements and vitamins) to food for improving the effectiveness and nutritional value. These types of nutraceutical include breeding at the agriculture level or addition of compatible nutrients to the main ingredients such as minerals added to cereals, flour fortified with calcium, iron, and folic acid, and milk fortified with cholecalciferol commonly used for vitamin D deficiency (Singh and Sinha, 2012; Casey et al., 2010).

### ***Recombinant nutraceutical***

As the word itself indicate these are essential nutrient providing food stuffs formed by recombination with the help of biotechnology. Biotechnology tools have been well applied through a process of various materials such as yogurt, alcohol, fermented starch, vinegar, cheese, bread and so on. And used for extraction of bioactive components by enzymatic or fermentation technology the enzyme useful for providing necessary nutrients at an optimum level (Beck et al., 2011).

### ***Traditional nutraceutical***

These are natural substances with no changes to the foodstuff or do not undergo any manual changes to the actual foods other than the way the consumer perceives them. It is simply natural, whole foods with new information about their potential health qualities. Many fruits, vegetables, grains, fish, dairy and meat products contain several natural components that deliver benefits beyond basic nutrition, such as lycopene in tomatoes, omega-3 fatty acids in salmon (Singh and Sinha, 2012). They are also grouped based on Chemical Constituents.

### ***Herbals***

The herbs possessing medicinal values to be implicated in the treatment and prevention of ailments are included in the class. Herbals are as old as human civilization and they provide a complete storehouse of medications to cure acute and chronic diseases. India has the oldest written tradition for nature's remedies called Ayurveda which possess many effective means of ensuring health care. Numerous nutraceuticals are present in medicinal herbs of key components (Prabu et al., 2012). Examples include willow bark (*Salix nigra*), having active component salicin, which is anti-inflammatory, analgesic, antipyretic, astringent and ant arthritic. Parsley contains flavonoids and is diuretic, carminative and antipyretic. Peppermint contains menthol as an active and

cures cold and flu. Lavender contains tannin which helps cure depression, hypertension, stress, cold, cough and asthma (Rajasekaran et al., 2008).

### Nutrients

As defined by Association of American Feed Control Officials (AAFCO) in 1996 it is a feed constituent in a form and at a level that support the life of an animal (*Table 1*). The chief classes of feed nutrients are proteins, fats, carbohydrates, minerals, vitamin, and water (Sapkale et al., 2012).

**Table 1. Common nutrients and their associated health benefits.**

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	Helps in energy production and other chemical processes in the body, helps maintain healthy eyes, skin and nerve function.
Vitamin B3	It helps to convert food into energy and maintain proper brain function.
Vitamin B6	Produce the genetic material of cells, formation of RBCs, maintenance of the central nervous system and synthesize amino acids and metabolism of fats, protein, and carbohydrates.
Folic acid	Produce the genetic materials of cells, in pregnancy for preventing birth defects, RBCs formation, protects against heart disease.
Calcium	Bones and teeth and maintaining bone strength important in nerve, muscle and glandular functions
Iron	Energy production, carry and transfer oxygen to tissues.
Magnesium	Healthy nerve and muscle function and bone formation, may help prevent premenstrual syndrome (PMS). Formation may help prevent premenstrual syndrome (PMS).
Phosphorous	Strong bones and teeth, helps in the formation of genetic material, energy production and storage.
Chromium	With insulin helps to convert carbohydrates and fats into energy.
Cobalt	Essential component of vitamin B12, but ingested cobalt is metabolized <i>in vivo</i> to form the B12 coenzymes.
Copper	Essential for hemoglobin and collagen production, healthy functioning of the heart, energy production, absorption of iron from the digestive tract.
Iodine	Essential for the proper functioning of the thyroid.

*Sumber: Allen (1997).*

### Probiotics

Probiotics are defined as live microbial feed additive that beneficially affects the host by improving its intestinal balance. They are friendly bacteria that promote healthy digestion and absorption of nutrients. Microorganisms used in animal feed are mainly bacterial strains of gram-positive bacteria belonging to the types *Bacillus licheniformis* (*B. licheniformis*) *B. subtilis*, *Enterococcus* (*E. faecium*), *Lactobacillus* (*L. acidophilus*, *L. casei*, *L. farciminis*, *L. plantarum*, *L. rhamnosus*), *Pediococcus* (*P. acidilactici*), and *Streptococcus* (*S. infantarius*); some other probiotics are microscopic fungi such as strains of yeast belonging to *Saccharomyces cerevisiae* and *Kluyveromyces*.

### Possible mode of actions of probiotic

Probiotics work in the gastrointestinal system of mammals or birds through different pathways such as maintaining a healthy balance of bacteria in the gut by competitive exclusion (the process by which beneficial bacteria are excluded potential pathogenic bacteria through competition for attachment site in the intestine and nutrients) and antagonism promoting the gut maturation and integrity, modulating the immune system and preventing inflammation, improving the metabolism by increasing digestive enzyme activity and decreasing bacterial enzyme activity and ammonia production, improving feed intake and digestion (as a result from the improved microbial balance in the gut),

and neutralizing enterotoxins and stimulating the immune system (Brisbin et al., 2010; Lutful Kabir, 2009).

### ***Prebiotic***

Prebiotic is described as a non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and activity of one or a limited number of bacteria in the colon, and thus improves host health (Gibson et al., 2010). It is selectively fermented ingredient that allows specific changes; both in the composition and/or activity in the GI micro biota that confers benefits upon host well-being and health (Roberfroid, 2007; Gibson et al., 2004). Prebiotics as substrate is no digestible feed ingredients that influence the micro biota in a manner favorable for host health by stimulating growth or activity of potentially positive microbial flora in the intestine (Patterson and Burkholder, 2003). The common example of prebiotics used in poultry are oligosaccharides, including inulin, fructose oligosaccharides (FOS), manna oligosaccharides (MOS), galactooligosaccharides (GOS), soya-oligosaccharides (SOS), xylo-oligosaccharides (XOS), pyrodextrins, isomalto-oligosaccharides (IMO) and lactulose (Alloui et al., 2013; Huyghebaert et al., 2011).

Prebiotic to be effective, it is important to fulfill criteria including being Non digestibility (i.e., resistance to low pH gastric acid, enzymatic digestion, and intestinal absorption in the upper part of the GIT), Good fermentation by the large intestinal micro biota; this can be investigated by measuring breath hydrogen or fecal recovery of the administered carbohydrate after a single prebiotic meal, and selective stimulation of growth and activity of intestinal bacteria (i.e., measuring bacterial counts in fecal samples, or intestinal content, before and during exposure to the test material in batch or multichambered fermentation systems) that have associated health-promoting effects (Macfarlane, 2010; Verse and Schrezenmeir, 2008).

### ***Health benefit of nutraceutical in animals***

#### ***Joint disease (Arthritis)***

Arthritis is a chronic debilitating disease that commonly affects a large number of humans and animals around the world. Currently, the two most common types of arthritis are osteoarthritis (OA) and rheumatoid arthritis (RA) (Van Meurs, 2017). Osteoarthritis is an inflammatory heterogeneous chronic degenerative joint disease (DJD) characterized by chronic and progressive degradation of the articular cartilage, osteophyte formation, thickening and sclerosis of the sub chondral bone, bone marrow lesions, hypertrophy of bone at the margin, synovitis, synovial fluid effusion, and fibrosis. Eventually, an animal's quality of life is compromised due to decreased stability, decreased mobility, loading, stiffness of joints, lameness, and pain, and in advanced stages, animals are unable to walk. RA is a chronic disease characterized by inflammation, pain, swelling, and stiffness of multiple joints. Among all animal species, dogs and horses suffer more with arthritis, and OA occurs with a greater frequency. The etiology of OA is multifactorial involving age, injury, lack of exercise/excessive exercise, nutritional deficiency, metabolism, obesity, genetic predisposition, infection, environment, etc. (Gupta et al., 2019).

#### ***A-Glucosamine and chondroitin***

Glucosamine is an amino saccharide that occur naturally in the body a precursor to a molecule called a glycosaminoglycan-this molecule is used in the formation and repair of cartilage. Glucosamine sulfate stimulates the production of hyaluronic acid in joint fluid. Hyaluronic acid relieves pain and improves mobility by repairing damaged cartilage. The in vitro experiment of Glucosamine has shown a dose dependent increase in proteoglycan after administering it (McAlindon et al., 2000).

### ***Avocado/soybean unsaponifiables***

Avocado and soybean unsaponifiables (ASU) have been used in the treatment of OA for decades. The active ingredients of this extract are a sterol-rich hydrolyzed lipid fraction and synergism between the avocado and soya components ASU appears to stimulate (ECM) extracellular matrix synthesis (Castrogiovanni et al., 2016).

### ***Nutraceuticals for control of ticks, fleas and other ectoparasites***

Currently, synthetic insecticides of various classes are used to combat ectoparasites on animals but due to their greater toxicity, lack of selective toxicity, development of insect resistance to synthetic insecticides, and rising costs, encourage researcher to produce environmentally friendship, cheap, and effective insecticide (Gupta, 2006). Nowadays, thousands of plants have been tested for insect repellency and insecticidal effects. Intense research efforts are underway to find plant extracts and phytotoxicants that have repellent,larvicidal,and adulticidal effects against ticks, fleas, lice, flies, mosquitoes, and other ectoparasites. The inhibition of enzymes, such as acetyl cholinesterase (Ache), butyrylcholinesterase (BuChE), tyrosinase,  $\alpha$ -amylase, endonucleases, cellulase, and others, is used for insect control, altering the central nervous system (CNS), and growth (Pulido et al., 2017; Sami et al., 2016). In developing countries, plant extracts are commonly used to repel or kill ticks, flies, and other ectoparasites. For example, 28 plants from Ethiopia showed promising repellency activities against adult *Rhipicephalus pulchellus* ticks, with *Calpurnia a urea* displaying the highest toxicity toward the ticks (Zorloni, 2007).

### ***PepperMint oil***

Peppermint oil is obtained from *Mentha piperita*. Peppermint has natural insect repellent and larvicidal properties. In case of mosquito bite itch, the mixture of peppermint oil (10 drops) and tea tree oil (10 drops) in carrier oil can relieve the discomfort by soothing and healing effect (Ansari et al., 2000).

### ***Clove oil***

Clove oil is extracted from *Eugeniacyophyllata* and consists of several phytoconstituents, including sesquiterpenes, eugenol, thymol, carvacrol, and cinnamaldehyde. Clove oil is reported to repel mosquitoes, ticks, mites, and other biting insects. Additionally, clove oil exerts an ovicidal and larvicidal effect against *Culex pipiens* and *Pediculus capitis* and ticks and mites. The compound eugenol appears to be responsible for insect repellency as well as for acaricidal activity toward *Dermatophagoides farinae* and *D. pteronyssinus*, Clove oils should be used on pets with caution, as an over dose may result in toxicity.

### ***Neem extract***

Neem tree is native to the Indian subcontinent, Australia, Africa, and Central and South America. Neem tree extract is found to exert anti diabetic, antioxidant, anti-inflammatory, immune stimulant, antitumor, antimicrobial (antibacterial, antiviral, and antifungal), anti parasitic (insecticidal and anthelmintic), skin diseases, fever, hepatoprotective, and spermicidal activities. Neem extracts have hormones that mimic and interfere with the life cycle of parasites, inhibit their ability to feed, and prevent the eggs from hatching. Ancient Indian texts call it “the curer of all ailments.” The National Academy of Sciences published a report in 1992 entitled “Neem: tree for solving global problems” (Abdel-Ghaffar et al., 2012).

### ***Role of nutraceutical in animal production***

Nutraceutical used in animal nutrition, can bring the following benefits, they enable the modification of sensory characteristics of feed to create an odor and flavour attractive for the animals-effects that can be achieved by addition of cinnamon, cloves, cardamom, bay leaves or mint to the feed (Czech et al., 2009). They regulate the functions of the animals’ digestive system, ensure their well-being and impact the speed and direction of metabolism inside the body. The ones worth mentioning are: turmeric, pepper, ginger, anise, mint, onion, fenugreek and cumin. Chemicals herb influencing bile acids synthesis and their secretion in the liver, which has a positive impact on the digestion and the absorption of lipids (FrAnKIČ et al., 2009). They have a positive impact on the digestive tract ecosystem of animals, primarily by inhibiting pathogenic microbial growth (Si et al., 2009).

### ***Nutraceutical as growth promoter***

#### ***Phytochemicals as growth promoters***

These are the chemical constituents of plants with distinct biological actions. These are reported to have active components which exert their effects on the metabolism and biochemical reactions in living beings and thus, provide health benefits (Dillard and German, 2000). Due to restrictions in several countries on the use of antibiotic as growth promoters in animal production like (poultry, beef, and pork), replacing nutraceutical is great interest. Phytochemical are chemicals produced by plants like (genistein, daidzein, soybean isoflavone, etc.) and are an extremely large group of compounds with great diversity in chemical structure and bioactivity. The active compounds in plants vary widely depending on intrinsic factors, such as the plant part used, the harvest season and the geographical origin, and extrinsic factors, such as the additive production technique. The use of phytochemicals in animal feed is accepted by consumers as herbal medicines have been consumed by humans for centuries .Currently, phytochemicals have not only been proposed as a replacement for antibiotic growth promoters but also for other anabolic compounds that are used to increase animal growth (Surai, 2014; Herrera et al., 2011). These compounds are being replaced because current trends indicate that consumers are increasingly rejecting the use of synthetic substances in food production; therefore, plant-derived compounds with growth-promoting activity, also known as phytogenic compounds, are gaining a presence in the feed additive market (Kuldeep Dhama et al., 2014; Golestan, 2010).

### ***Principal mechanisms***

Based on the different biological activities of phytochemicals, the following principal mechanisms have been proposed (Bahadoran and Mirmiran, 2015; Krause et al., 2005).

#### ***Improver of oFood status and animal food intake***

Some phytochemical additives enhance the flavor and palatability of feed, which improves feed intake and productive performance. The proposed modes of actions of nutraceutical as growth promoter are including Improved the feed antioxidant status, Decreased the antimicrobial colonization and increased the stimulation of appetite (Muanda et al., 2011; Velasco and Williams, 2011).

#### ***Modulator of ruminal fermentation***

Microbiota in the rumen and ruminant physiology are manipulated to enhance the productivity and health status of an animal. The activities of the rumen microbiota, including protein digestion and synthesis, carbohydrate digestion and vitamin synthesis, are important for obtaining an adequate production profile of volatile fatty acids (propionate, acetate and butyrate), mainly propionate, since most energy maintenance and growth performance is linked to (Choudhury et al., 2015). Phytochemical has four recognized modes of action that explain how to exert their antibacterial effect and the changes that occur in rumen microbiota via inhibition of cell wall synthesis, disruption of cell wall structure (altering the permeability of the cytoplasmic membrane), inhibition of nucleic acid synthesis, inhibition of protein synthesis and inhibition of a unique bacterial metabolic pathway. These actions lead to the collapse of core cellular activities and, consequently, result in bacterial death (Lean et al., 2014).

#### ***Improver of nutrient digestion and absorption***

Phytochemicals promote improvement of nutrient digestion and absorptions in animals in several way like increasing digestive secretions (saliva, digestive enzymes, bile, and mucus) decreased bacterial counts and pathogen loads via an antibacterial effect in the intestinal lumen developed antioxidant and antiinflammatory activities in the intestinal lumen, resulting in improved gut morphology prebiotic activity and reduced fermentation products, such as nitrogen compound waste (Costa et al., 2013; Jamroz et al., 2005).

#### ***Challenges associated with delivery of nutraceuticals***

Nutraceuticals is a subject that is not so known to the people and it still needs awareness in common people regarding its use and ability for its potential. The requirement to deliver an effective dosage of nutraceuticals for a specific health benefit is a major challenge, as it impacts the taste and aroma of the final product. The nutraceutical formulations are been taken not as only medicines but as diet. Hence, unlike the pharmaceutical preparations, nutraceutical preparations need to fulfill a whole lot more requirements. Since, the nutraceuticals include dietary supplements, functional foods, etc; the components used in the formulation must be of food grade. Therefore, the selection of suitable material for the preparation of the formulation is a great challenge. After the selection of the materials, the next challenge appears in the selection of the delivery system. The nutraceutical materials consist of biological

products such as herbal extracts, proteins, peptides, vitamins, and hormones which tend to degrade easily. The stability of the formulation is a factor that cannot be compromised. Thus, a suitable delivery system must be chosen on the grounds of its ability to deliver the food product effectively, exerting its desired effect (Crandell and Duren, 2007).

## Conclusion

In the modern medicine nutraceutical take a crucial part for peoples and animals in prevention and treatment of various diseases. Nutraceutical has abundant role in modern animal production in addition nutraceutical has great role in minimizing development of multiple gene resistant pathogens and side effect caused by allopathic medicine. These products are extremely important to obtain therapeutic outcomes and have intense effect on cell metabolism, and possess little or reduced side effects. Even though it has plenty of benefits has also its own basic limitation. Because it is recently developing peoples lack enough knowledge and also there is problem associated with the delivery and processing of this product. Based on the above conclusion the following recommendations are forwarded: (1) in order to have scientific knowledge about the nutraceutical, people should be educated on the use of this product for their animals; as well as (2) problems associated with delivery and processing of nutraceutical should be solved through further investigation.

## Acknowledgement

This research is self-funded.

## Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

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