

## SCOPE OF NUTRACEUTICALS IN LIFESTYLE DISEASES OF PET ANIMALS: A BRIEF OVERVIEW

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**Abstract:** Innovation and technology has crept into diet of humans as well as their pets. Incorporation of bioactive chemicals in diet in form of pills, tablets etc has led to nutraceutical revolution. Nutraceuticals are the novel products that incorporate food extracts or bioactive agents from a food having health benefits. These compounds have shown promising results as either alternative to medicines or being complementary in prevention and treatment of lifestyle diseases. The biological activity of nutraceuticals has been well established but there are concerns regarding bioavailability, dosage, metabolism and tissue distribution. Glucosamine, Omega 3 fatty acids, anti-oxidants, S-adenosyl methionine, etc. are the main compounds that have well been accepted and adopted by the commercial ventures for prevention of osteoarthritis, fatty liver and oxidative stress in pets. The vastness of nutraceutical science can be explored further in terms of interaction with synergists and different routes and modes of delivery.

**Keywords:** Nutraceuticals, Lifestyle diseases, essential fatty acids, functional foods, pet health.

### Introduction

While the world is facing challenges from emerging diseases caused by pathogens like Ebola virus and Zika virus, majority of people are battling against a self created malady called lifestyle diseases. The present apartment culture, living in air-conditioned rooms, gorging unchecked junk food and travelling in swank sedans has rubbed off on the companion animals as well. The diseases are taking gruesome toll on the pets following their human master's daily routine. In India, almost 40% of pets suffer from lifestyle diseases like obesity, osteoarthritis, diabetes, kidney disease, gastric trouble and high cholesterol levels. The holistic pet health can be ensured by appropriate nutrition, maintenance of the

musculoskeletal system and managing the immune system. As said by the father of medicine, Hippocrates, “Let food be thy medicine” focus on nutrition can easily avoid these ailments. Pet parents seek a wider range of food and beverage choices in the market that help them to fulfill health and wellness needs of their pets. Nutraceuticals have become popular within the veterinary community with worldwide estimates of sales approaching almost \$100 billion. They have been described by the North American Veterinary Nutraceutical Council as a “non-drug substance that is produced in a purified or extracted form and administered orally to provide agents required for normal body structure and function with the intent of improving the health and well-being of animals”(Abigail and Lockwood., 2007). Nutraceuticals have broad spectrum of effects, including immune regulation; control or elimination of infection by bacteria, viruses and parasites; support of normal organ structure, function, or blood supply and enhancement of normal metabolic processes. There are at least two major categories of functional foods and nutraceuticals. The first includes foods that are naturally rich in nutraceutical components, and the second includes foods formulated with added nutraceutical ingredients in efficacious amounts, often with a health benefit or disease prevention target in mind. Some important nutraceuticals and their sources have been tabulated below:

Nutraceutical	Examples	Source
Lipids	Eicosapentaenoic acid, docosahexaenoic acid, alpha-linoleic acid	Fish, algae, krill, flaxseed, calamari, canola, genetically modified plants and seeds
	Conjugated linolenic Acid	Milk fat
Probiotics	<i>Lactobacillus</i> , <i>Bifidobacterium</i>	Bacteria
Phenolic compounds and polyphenols	Phenolic acids, resveratrol, curcuminoids, catechins, flavonols, flavanols, flavones	Tea, grapeseed, grapes, olives, pomegranates, vegetables, seeds, wine, cocoa
Carotenoids	$\beta$ -carotene, lycopene, lutein, astaxanthin	Carrots, tomatoes, marigolds, green leafy vegetables, microalgae
Bioactive peptides	Various peptides	Milk, meat, fish, plants
Minerals	Ca, Fe, Mg, Zn	Usually available as salts
Vitamins	Water- and fat-soluble Vitamins	Usually available as chemically synthesized compounds

Dietary lipids are beneficial in reducing risk of atherosclerosis which further improves cardiovascular health, cognition, brain health and reduces risk of certain cancers (Lane and Derbyshire, 2014). The essential fatty acids like linolenic acid have been reported to be useful in reducing risk of atherosclerosis, besides possessing anticarcinogenic and anti-inflammatory properties (Bassaganya-Riera et al., 2002). Phenolic compounds decrease oxidative stress and protect against cardiovascular, neurodegenerative, metabolic diseases and cancer (Aboul-Enein et al., 2013). Carotenoids have been long back recognized to be beneficial against age related macular degeneration and maintaining normal vision (Cooper, 2004). The advantages of including probiotics in the normal diet are numerous which include maintaining intestinal flora and immune health.

Growing health care costs are placing a burden on pet owners and foods that contain a combination of nutraceutical ingredients are emerging in the market strongly because of their possible synergistic health effects (Shahidi, 2012). Scientists have made number of advances in incorporation of nutraceuticals in human diets but the amount of research done on nutraceutical use in naturally acquired disease in dogs and cats is miniscule. Nutraceutical use is being explored by veterinarians in most species of animals, including reptiles, marine mammals and birds. Most veterinary clinical experience comes from their use in horses, cats, and dogs. The consumption of functional foods with added nutraceuticals is an alternative to dietary supplements in tablet or capsule formats. Some of the nutraceuticals commonly added in dog and cat food include the following:

### **Omega-3 essential fatty acids**

Since mammals are not able to synthesize these fatty acids on their own, therefore, they must be supplied in the diet. Numerous health benefits have been attributed to an increased N-3 EFA intake. The mere difference of site of saturation between omega 3 and omega 6 fatty acids makes them anti-inflammatory and pro-inflammatory respectively. A huge amount of literature is available in support of beneficial effects of supplementation of food with omega-3 EFAs in heart disease, cancer, chronic kidney disease, cognitive dysfunction, skin disease and joint disease in humans as well as in dogs. For example, in dogs with experimentally induced chronic kidney disease, supplementation with omega-3 EFAs was compared to omega-6 EFAs and saturated fat to provide the same final fat content in the base diet over a two-year period (Brown et al., 1998). The dogs supplemented with omega-3 EFAs had a higher glomerular filtration rate and decreased proteinuria, creatinine concentrations and renal interstitial fibrosis as compared to the omega-6 EFA group.

Published studies in dogs with osteoarthritis (OA) have demonstrated improved weight bearing on the affected limb(s) (Fritsch et al., 2010) and improved activity levels (Roush et al., 2010a). In addition, one study demonstrated a decreased requirement for NSAIDs to control OA symptoms, when animals were given a diet supplemented with N-3 EFAs (Roush et al., 2010b).

Omega 3 fatty acids are believed to antagonize catabolic changes in the body and effectively help in improving the individual's ability to fight the disease. In-vitro studies have revealed the role of N3 EFAs in inhibiting angiogenesis through alteration in prostaglandin synthesis and inhibition of protein kinase-C.

### **Silymarin**

Silymarin is a beneficial component of milk thistle useful for treating hepatobiliary disease due to its antioxidant, anti-inflammatory and antifibrotic properties. One feline study using an experimental model of liver toxicity showed that administering silymarin provided complete protection against acetaminophen-induced liver toxicity if given within four hours of toxin administration (Avizeh et al., 2010).

Silymarin preferentially accumulates in liver and is excreted in bile. Besides having a short plasma half-life, there are concerns of erratic and unpredictable bioavailability of silymarin. The dose required to achieve a therapeutic effect in companion animals is unknown, therefore doses are generally extrapolated from human studies. Therapeutic formulations should contain 70 to 80% silymarin, but extract purity varies widely. Siliphos, a formulation of silibin complexed with phosphatidylcholine, is a relatively new product that has been shown to be three to five times more bioavailable than silymarin.

### **Lysine**

It is an essential amino acid and is beneficial in maintaining vascular integrity. Apart from its role in immune function, it is indicated in equine herpes virus infection, feline herpes conjunctivitis and respiratory diseases.

### **Taurine**

It is essential for cardiac function as it modulates cardiac activity by stabilizing cell membrane transport. It has an ionotropic effect.

### **Glucosamine and combinations**

Combination of N-acetyl glucosamine (NAG), digestive enzymes, *Lactobacillus acidophilus* & alfalfa helps strengthen the protective layers of the GI tract, aids digestion and eases food allergic reactions. Animals with irritable bowel, colitis, etc. require increased amounts of

NAG to maintain digestive tract lining integrity. *Lactobacillus acidophilus* is an acid producing beneficial microbe which aids in the manufacture of B vitamins, digestive enzymes and help maintain proper pH in the gut. Alfalfa is an excellent source of Vitamin K and chlorophyll. Among minerals, potassium and magnesium affect heart muscle function while vitamin E and selenium are equally important for proper cardiac function.

### **S-adenosyl methionine (SAM-e)**

Most of the cellular damage occurs due to oxidative stress and liver is the key organ combating it. The liver has many complex antioxidant systems, and glutathione plays a major role. Glutathione concentrations are steadily maintained in the body by a biochemical pathway involving conversion of methionine to cysteine. In addition to this antioxidant function, SAM-e also plays a role in preventing apoptosis in normal cells, modulating cytokine expression and stabilizing membrane functions.

Some double-blinded, placebo-controlled studies support the clinical benefits of SAM-e in humans (Frezza and Terpin., 1992) and a number of trials on experimental models in animals, including dogs and cats (Center et al., 2005, Wallace et al.,2002) have been conducted. SAM-e has a short half-life and poor bioavailability. Therefore, tablets are enteric coated and administered on an empty stomach. Side effects include nausea and poor appetite. A double-blinded, placebo controlled study in dogs with evidence of cognitive dysfunction has shown marked improvement in activity levels and awareness when dogs were supplemented with SAM- e (Reme et al., 2008). Hence, SAM-e should be recommended to dogs with this disease.

### **Shortcomings associated with nutraceuticals**

Apart from the benefits of nutraceuticals, one must not overlook the side effects associated with them. Some of the potential hazards include mercury and lead toxicity as these are present as contaminants in omega 3 fatty acid preparations. Polychlorinated biphenyls (PCBs) have also been found in traces in many nutraceutical preparations. Herbal products may be contaminated with pesticides and herbicides.

### **Conclusion**

Nutraceuticals can be an excellent adjunct to conventional medications as no one form of medicine has all the answers. Counting on the concept of Integrative Veterinary Medicine, which involves using the best of conventional veterinary medicine along with complementary therapies, nutraceuticals can be considered as an integral part of this approach. Advances in nutrigenomics and improved understanding of the impact of diet and lifestyle on pet health

will provide the impetus for the industry to develop more tailored formulations for different breeds of companion animals. This development, in turn, will propel expansion of the nutraceutical markets globally.

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