

# AMPHI-PET

*Maximum Strength  
nanoemulsion spray*

*Advanced nanoemulsion liquid additive designed to fortify dry or wet pet food with essential nutrients including vitamins, minerals, probiotics, prebiotics, amino acids, nutraceuticals and immune boosters for optimal health and well-being.*



**YOUR PRECIOUS PET  
DESERVES THE BEST**



## Nanotechnology and its Applications in Pet Feed Additives (Nano-sized Feed Additives)

### Physical, chemical, and biological properties of nano-sized feed additives

- ◆ Nanoparticles have unique physical, chemical, and biological properties, such as **enhanced material strength, improved solubility, increased conductivity, optical properties, thermal dynamics, and catalytic efficiency** (Alhashmi Alamer & Beyari, 2022; Khan & Hossain, 2022).
- ◆ The increased surface area of nano-sized particles can have a positive effect on many factors such as **digestibility, nutrient absorption, immune system, growth and development** (Hatab et al., 2022; Hussain et al., 2023). These advantages are used to **increase the bioavailability** of feeds through the size effect and high surface reactivity.
- ◆ **Minerals in NP form used as feed additives can increase absorption rates by penetrating the gastrointestinal barrier and entering the body's cells faster than larger particle sizes** (Bunglavan et al., 2014; Jafari & McClements, 2017).

*Reference: Importance of Nano-Sized Feed Additives in Animal Nutrition. Journal of Agricultural Production (2024), 5(1), 55-72*

- ◆ Nanotechnology is utilized in feed processing to deliver nutrients to target organs through methods like encapsulation, chelating, packing, and nanotubes without altering taste or color. Nanoparticles could be prepared using nanotools in nanotechnique such as precipitation, emulsion cross-linking, spray-drying, emulsion-droplet coalescence, etc.
- ◆ Nanoparticle synthesis is performed by physical (high-energy ball milling, vapor deposition), chemical methods (forming colloids), and biological methods.

*Reference: Understanding Concepts of Feed Additives in Animal Nutrition: their Potential in Improving Livestock Production Performance and Product Quality. A Publication of Unique Scientific Publishers*

- ◆ Nanotechnology additives are being touted as an alternative to increase feed efficiency, reduce the cost of animal nutrition, protect animal and human health and to improve safety and environmental factors.

*Reference: Contribution of nanotechnology to greater efficiency in animal nutrition and production. J Anim Physiol Anim Nutr. 2024;108:1430-1452.*



## Benefits of nano-sized feed additives in animal nutrition

- ◆ **Nano-sized feed additives such as nanoparticles** (NPs) are extremely small particles that can provide various benefits in animal nutrition (Yadav et al., 2022).
- ◆ These additives can improve both the quantity and quality of safe, healthy and functional animal products. The results of the latest research show that **incorporating nanomaterials into animal feed can lead to improved animal growth, better-feed utilization and more efficient nutrient conversion** (Seven et al., 2018; Abdelnour et al., 2021). In addition, nanomaterials can help **improve digestion and absorption of nutrients in animals, resulting in better overall metabolism and physiology** (Abdelnour et al., 2021)
- ◆ Nano-sized feed additives, especially **nanominerals, have superior bioavailability compared to conventional minerals**. This means that **animals require less of these additives to obtain the same nutritional benefits**.
- ◆ Nano-sized feed additives have the effect of **increasing growth, removing residues, reducing environmental pollutants, contributing to the production of non-polluting animal products, improving the immune function of animals, and reducing the risk of disease** (Dei, 2021).
- ◆ In addition, When feed additives are combined **with encapsulation at the nano scale, they are better recognized and utilized by the animals' bodies** (Albuquerque et al., 2020).

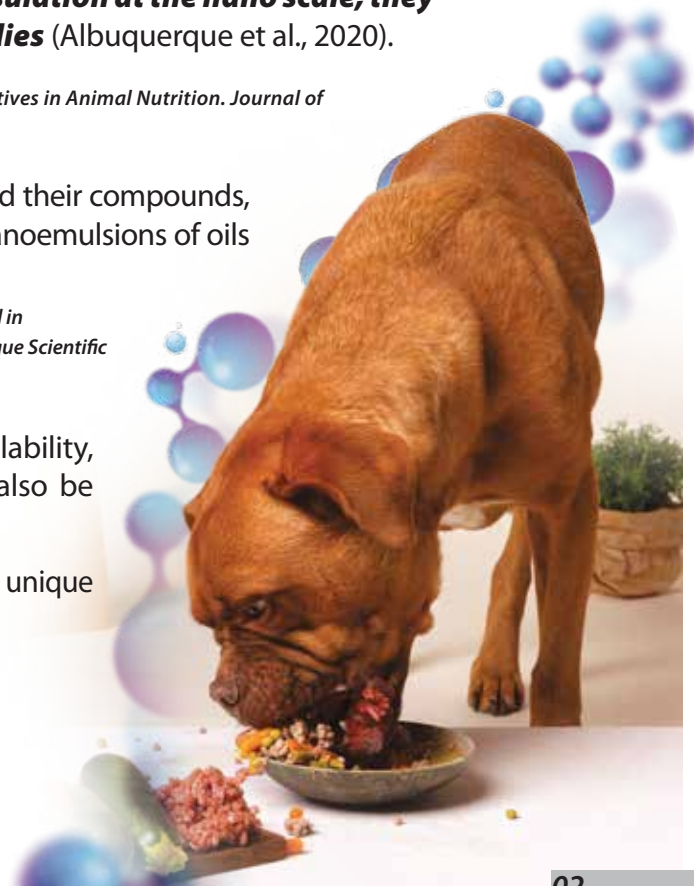
*Reference: Importance of Nano-Sized Feed Additives in Animal Nutrition. Journal of Agricultural Production (2024), 5(1), 55-72*

- ◆ For improving stability and bioavailability, of essential oils and their compounds, nanoemulsion as a novel strategy is recommended. Using nanoemulsions of oils effectively mitigated their release in GIT (Ibrahim et al., 2022).

*Reference: Understanding Concepts of Feed Additives in Animal Nutrition: their Potential in Improving Livestock Production Performance and Product Quality. A Publication of Unique Scientific Publishers*

- ◆ Nano-minerals offer low dose usage and improved bioavailability, making them an effective antibiotic alternative and can also be incorporated into natural feed ingredients.
- ◆ Enzyme nanoparticles are protein aggregates that show their unique properties (optical, electrical).

*Reference: Application of nanotechnology in animal nutrition: Bibliographic review. Gelaye, Cogent Food & Agriculture (2024), 10: 2290308*





## **Nanoencapsulation and its Value for Probiotics and Enzymes in Nano-sized Pet Feed Additives**

### **1- Nanoencapsulation of probiotics**

#### **Value of nanoencapsulation of probiotics**

- ◆ The application of nanotechnology in food sector is already a reality and includes delivery systems for bioactive compounds, the use of nano-sized food ingredients and additives, and food packaging. **The general term used to describe these products is 'nano-foods'** (Dasgupta, Ranjan, & Mundekkad, 2015; Jafari & McClements, 2017; Paul, 2015). They are also known as **'functional foods'** (Jafari & McClements, 2017; Mishra, Behera, Biswabandita, & Ray, 2018).
- ◆ Functional foods **encompass bioactive ingredients like probiotics, prebiotics, fiber, vitamins, and minerals. Recently, micro- and nanoencapsulation have been used to shield probiotic strains against detrimental factors such as pH, light, water, oxygen, moisture, heat, etc., thereby enhancing the survival rate and improving bioavailability, functionality, and nutritional value.**
- ◆ Microbial nanoencapsulation strategies become promising options to enhance their survival because **they allow the creation of optimal microenvironments for their stability and survival.**
- ◆ Additionally, encapsulation helps **mask unfavorable flavors and odors while adding targeted release properties as well as enhances the physico-chemical & organoleptic properties of food-based probiotic products** (Augustin & Hemar, 2009; Fung et al., 2011; Tolve et al., 2016; Hosseini & Jafari, 2020; Kaur et al., 2022; Sun et al., 2023).
- ◆ In the encapsulation technique, **probiotics are packed (core material) or dispersed into another compound (coating, membrane, shell, or wall material) to shield them from environmental conditions** (Tolve et al., 2016; Ahmad et al., 2019; Hosseini & Jafari, 2020).

*Reference: Nanoencapsulation of probiotics: Need and critical considerations to design new non-dairy probiotic products. Journal of Functional Foods 116 (2024) 106192*

#### **Nanoemulsions of probiotics**

- ◆ Emulsions have been extensively used in the food industry to **enhance bioactive molecules' solubility, bioactivity, and stability** (Alemzadeh, Hajiabbas, & Pakzad, 2020; Rodrigues, Cedran, Bicas, & Sato, 2020).
- ◆ **Emulsion systems are colloidal dispersions** typically composed of two or more immiscible liquids, commonly water and oil.

*Reference: Nanoencapsulation of probiotics: Need and critical considerations to design new non-dairy probiotic products. Journal of Functional Foods 116 (2024) 106192*



## 2- Nanoencapsulation of enzymes

### Importance of enzyme nanoencapsulation

#### 1- Improved Stability

- ◆ There, generally, is a **temperature** range where each enzyme demonstrates its optimal performance. Unless enzymes were originally extracted from thermophilic organisms, this range mostly tends to lie between 30 to 50 oC .
- ◆ Similarly, both for digestive and technological processes, there is an **optimum pH** range where enzymes demonstrate maximum stability and performance. The changes in medium pH clearly affects the rate of enzymatic reactions.
- ◆ In that sense, **encapsulation** systems can stabilize the structural characteristics of enzymes and prolong their period of activity. (e.g., Kınık, Kavas, & Yılmaz, 2003).

#### 2- Improved bioavailability

- ◆ The potential success of encapsulation applications depends on the fundamental characteristics of nanocarrier systems and the bioactive compound that they bear. There are rapid, robust, and reliable methods that can be used to characterize the basic characteristics of encapsulation systems such as particle size, morphology, wall thickness, chemical composition, and structure of the particle and the encapsulated material.
- ◆ It is imperative to assess the digestion kinetics and biostability of encapsulated Peptides and their bioavailability in different physiological sites to ensure the release of intact bioactives at appropriate time and target location.

*Reference: Nanoencapsulation of Enzymes, Bioactive Peptides, and Biological Molecules. CHAPTER 8 Muhammed Yusuf Caglar, Mehmet Demirci, Kadir Bayrambas, Bilal Cakır and Ibrahim Gulseren Istanbul Sabahattin Zaim University (IZU), Istanbul, Turkey, Tunceli University, Tunceli, Turkey*





# 1- Role and Importance of Vitamins and Anti-oxidants for Pet Health and Well-being

## Importance of vitamins for dogs

### 1- Vitamin A:

- ◆ **Physiological importance:** Has a role in vision; growth; immune function; fetal development; cellular differentiation and transmembrane protein transfer.
- ◆ **Deficiencies** can lead to anorexia; body weight loss; ataxia; conjunctivitis; corneal disorders; skin lesions; respiratory ailments; increased susceptibility to infection. Also can lead to imbalance in bone remodeling processes; artery and vein degeneration; dehydration; central nervous system depression and joint pain.

### 2- Vitamin D:

- ◆ **Physiological importance:** Maintenance of mineral status; skeletal structure; phosphorous balance.
- ◆ **Deficiencies** can lead to rickets; lethargy; loss of muscle tone; bone swelling and bending anorexia; weakness; diarrhea; vomiting; calcification of soft tissue; excessive mineralization of long bones; dehydration; dry and brittle hair and muscle atrophy and degeneration.

### 3- Vitamin E:

- ◆ **Physiological importance:** Defense against oxidative damage.
- ◆ **Deficiencies** can lead to degeneration of skeletal muscle; reproductive failure and retinal degeneration.

### 4-Vitamin K:

- ◆ **Physiological importance:** Activation of clotting factors, bone proteins, and other proteins.

### 5- Vitamin B1 (thiamin):

- ◆ **Physiological importance:** Energy and carbohydrate metabolism and activation of ion channels in neural tissue.
- ◆ **Deficiencies** can lead to failure to grow, weight loss and neurological abnormalities in puppies; damage to the nervous system and to the heart.

### 6- Riboflavin (Vitamin B2):

- ◆ **Physiological importance:** Essential for multiple enzymatic functions.
- ◆ **Deficiencies** can lead to anorexia; weight loss; muscular weakness; flaking dermatitis and eye lesions.

### 7- Vitamin B6 (Pyridoxine HCl):

- ◆ **Physiological importance:** Glucose generation; red blood cell function; niacin synthesis; nervous system function and immune response.
- ◆ **Deficiencies** can lead to anorexia and weight loss in puppies; convulsions, muscle twitching, and anemia in adult dogs Impairment of motor control and balance and muscle weakness.



### 8- Niacin (Vitamin B3):

- ◆ **Physiological importance:** Essential for multiple enzymatic functions.
- ◆ **Deficiencies** can lead to anorexia; weight loss; inflammation of the lips, cheeks, and throat; profuse salivation; bloody diarrhea ; bloody feces and convulsions.

### 9- Vitamin B5 (Pantothenic Acid):

- ◆ **Physiological importance:** Essential for energy metabolism.
- ◆ **Deficiencies** can lead to erratic food intake; sudden prostration or coma; rapid respiratory and heart rates; convulsions; gastrointestinal symptoms and reduced antibody production.

### 10- Vitamin B12 (Cobalamin):

- ◆ **Physiological importance:** Has a role in multiple enzymatic functions.
- ◆ **Deficiencies** can lead to appetite loss; lack of white blood cells; anemia and bone marrow changes.

### 11- Folic acid:

- ◆ **Physiological importance:** Amino acid and nucleotide metabolism and mitochondrial protein synthesis.
- ◆ **Deficiencies** can lead to weight loss and decline in hemoglobin

*Reference: YOUR DOG'S NUTRITIONAL NEEDS. A Science-Based Guide For Pet Owners. (based on Nutrient Requirements of Dogs and Cats, a technical report issued by the National Research Council as part of its Animal Nutrition Series.)*

## 2- Role and Importance of Chelated Minerals for Pet Health and Well-being

### Value of mineral chelation

- ◆ **Chelating** is the chemical process by which a mineral (iron, cobalt, copper, zinc, & manganese) is combined with a **mixture of amino acids and peptides**. The resulting substances are known as **chelates**. Another descriptive term, **proteinates**, refers to the amino acid bond.
- ◆ These chelated minerals are thought to be **more digestible than non-chelated forms. In other words, chelation makes the minerals more bioavailable (able to be absorbed and used for bodily functions)**, chiefly by shielding them from the effects of other dietary elements in the animal's digestive tract.
- ◆ **Proteinates** or **chelates** are described as **organic minerals** in contrast to **inorganic minerals**, those that are not bound to amino acids.

*Reference: chelated minerals in animal nutrition. International journal of Advanced Biological and Biomedical Research Volume 1, Issue 11, 2013: 1387-1391*



## **Importance of minerals for dogs**

### **1- Chelated Iron:**

- ◆ **Physiological importance of iron** include its role in synthesis of blood components and energy metabolism.
- ◆ **Deficiencies in iron** can lead to poor growth; pale mucous membranes; lethargy; weakness and diarrhea. At acute levels, dangerous oxidative reactions that lead to gastrointestinal and other tissue damage.

### **2- Chelated Copper:**

- ◆ **Physiological importance of copper** include its role in connective tissue formation; iron metabolism; blood cell formation; melanin pigment formation; myelin formation and its defense against oxidative damage.
- ◆ **Deficiencies in copper** can lead to loss of hair pigmentation in puppies and anemia.

### **3- Chelated Manganese:**

- ◆ **Physiological importance of manganese** include its role in enzyme functions; bone development and neurological function.
- ◆ **Deficiencies in manganese:** No studies of deficiency in dogs.

### **4- Chelated Zinc:**

- ◆ **Physiological importance of zinc** include its role in enzyme reactions; cell replication; protein and carbohydrate metabolism; skin function and wound healing.
- ◆ **Deficiencies in zinc** can lead to poor weight gain; vomiting and skin lesions.

### **5- Selenium Glycinate**

- ◆ **Physiological importance of selenium** include defense against oxidative damage; immune response.
- ◆ **Deficiencies in selenium** can lead to anorexia; depression; breathing discomfort; coma; muscular degeneration.

### **6- Magnesium Glycinate**

- ◆ **Physiological importance of magnesium** include enzyme functions; muscle and nerve-cell membrane stability; hormone secretion and function; mineral structure of bones and teeth.
- ◆ **Deficiencies in magnesium** can lead to reduction in weight gain, irritability, & convulsions in puppies; hyperextension of carpal joints and hind-leg paralysis later in life.

### **7- Potassium Iodide**

- ◆ **Physiological importance of potassium** include Acid-base balance; nerve impulse transmission; enzymatic reactions; transport functions.
- ◆ **Deficiencies in potassium** can lead to Poor growth in puppies; paralysis of neck muscles and rear legs and general weakness later in life.

*Reference: YOUR DOG'S NUTRITIONAL NEEDS. A Science-Based Guide For Pet Owners. (based on Nutrient Requirements of Dogs and Cats, a technical report issued by the National Research Council as part of its Animal Nutrition Series.)*



## 3- Role and Importance of Probiotics for Pet Health and Well-being

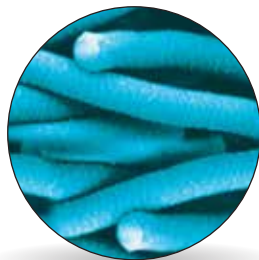
### **Mechanisms of action of probiotics**

- ◆ Probiotics have been proposed to **have multiple mechanisms of action**:
  - 1- Probiotics confer benefits to host health by **interacting with the resident microbiota** or by communicating with host cells.
  - 2- Probiotics can **improve the balance of the intestinal microbiota, enhance the integrity of the epithelial barrier, and maintain immune homeostasis** directly or indirectly.
  - 3- Probiotics **inhibit the colonization of pathogens** via colonization resistance and production of antimicrobial molecules such as bacteriocins and organic acids (e.g., lactic acid).
  - 4- Some probiotics, such as *L. plantarum*, stimulate the production of host-derived HDPs in humans and animals. **With antimicrobial and immunomodulatory activities, HDPs constitute an important component of host immune defense.**
  - 5- Moreover, **probiotics modulate immune functions by stimulating T-cell differentiation**, regulating pro- and anti-inflammatory cytokine profiles, and inducing sIgA production.

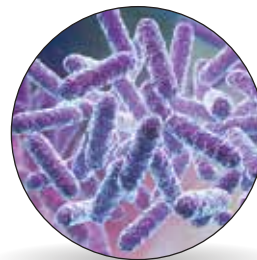
Reference: Gut Probiotics and Health of Dogs and Cats: Benefits, Applications, and Underlying Mechanisms. *Microorganisms* 2023, 11, 2452.2



**Lactobacillus plantarum**



**Lactobacillus acidophilus**



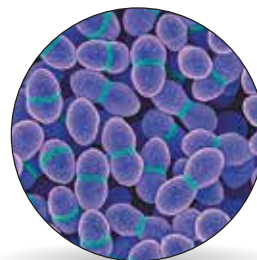
**Bacillus subtilis**



**Bacillus licheniformis**



**Bacillus coagulans**



**Enterococcus faecium**



## Applications of probiotics in dogs

- ◆ Studies have indicated that the use of probiotics **improves intestinal microbiota composition and changes microbial functions in healthy dogs** by adopting 16S rRNA gene sequencing, metagenomics and metabolomics.
- ◆ Feeding ***S. cerevisiae* yeast** increased the abundance of Turicibacter, decreased the abundance of E. coli, increased fecal butyrate, and shifted the microbial functional gene profile in healthy adult beagle dogs.
- ◆ Probiotics also exert immunomodulatory activities in dogs. Feeding a probiotic mixture elevated fecal IgA and plasma IgG. **Multistrain probiotics containing three strains improved the levels of serum IgG and fecal IgA.**
- ◆ Moreover, studies have suggested improved **fecal quality and reduced nitrogen fermentation** through probiotic treatments in dogs. Feeding ***S. cerevisiae* yeast** decreased the fecal pH and concentrations of total biogenic amines and ammonia. Dietary supplementation with ***Bacillus subtilis* and *Bacillus licheniformis*** improved the fecal score, reduced nitrogen fermentation products in feces, and **reduced fecal odor in dogs.**
- ◆ In addition, probiotics do not seem to affect the nutrient digestibility or growth performance of dogs, with one study indicating that a **multistrain probiotic compound improved feed intake and weight gain in dogs.**

- ◆ **Probiotics confer health benefits in dogs with various intestinal disorders. Studies have shown that multistrain probiotics improved clinical remission, suppressed inflammation, and increased epithelial barrier function in dogs diagnosed with IBD.**
- ◆ **Oral administration of a probiotic mixture accelerates clinical recovery and intestinal microbiota normalization in dogs with acute hemorrhagic diarrhea. A probiotic compound therapy increased the intestinal expression of tight junction proteins in dogs with idiopathic IBD**

Reference: Gut Probiotics and Health of Dogs and Cats: Benefits, Applications, and Underlying Mechanisms. *Microorganisms* 2023, 11, 2452.





## **4- Role and Importance of Prebiotics (Fructo-oligosaccharide, Mannan Oligosaccharide and Yeast Beta-glucan) for Pet Health and Well-being**

### **1- Role and importance of FOS (Fructo-oligosaccharide)**

**FOS enhances indices of gut health by positively altering gut microbial ecology and fecal protein catabolites.**

- ◆ FOS administration results in lower *Clostridium perfringens* and greater fecal butyrate and lactate concentrations.
- ◆ FOS supplementation increases bifidobacteria, increases lactobacilli, increases fecal lactate and butyrate, and decreased fecal ammonia, isobutyrate, isovalerate and total branched-chain fatty acid concentrations.
- ◆ Dogs fed LAC had the highest fecal concentrations of hydrogen sulfide and methanethiol and dimethyl sulfide, whereas dogs fed FOS had the lowest concentrations of these compounds.
- ◆ Overall, FOS appeared to enhance indices of gut health by positively altering gut microbial ecology and fecal protein catabolites, whereas LAC was more effective when fed in combination with FOS rather than fed alone.

*Reference: Fructooligosaccharides and Lactobacillus acidophilus Modify Gut Microbial Populations, Total Tract Nutrient Digestibilities and Fecal Protein Catabolite Concentrations in Healthy Adult Dogs. J. Nutr. 132: 3721–3731, 2002.*

**FOS has an antibacterial effect on potentially pathogenic bacteria.**

- ◆ FOS have been identified as prebiotics (Gibson and Roberfroid, 1995), which are food ingredients that are not digested by small intestinal enzymes but are fermented in the large intestine to stimulate selectively the growth of probiotic-like bacteria that are part of the commensal gut microflora (Salminen et al., 1998; Macfarlane and Cummings, 1999).
- ◆ It is likely that probiotic bacteria in the canine large intestine are stimulated similarly by dietary FOS (Strickling et al., 2000). The gut health benefits of prebiotics include the exertion of an antibacterial effect on potentially pathogenic bacteria through production of acids which causes a reduction in intestinal pH, reduction of ammonia levels through protonation of  $\text{NH}_4^+$ , production of B group vitamins, and immunomodulation in the gut mucosa (Gibson and Roberfroid, 1995).

*Reference: The effects of added fructooligosaccharide (Raftilose®P95) and inulinase on faecal quality and digestibility in dogs. Animal Feed Science and Technology 108 (2003) 83–93*



## **2- Role and importance of mannan oligosaccharide (MOS)**

### **Role and importance of mannan oligosaccharide (MOS) for dogs**

#### **1- MOS boosts cell-mediated immune response in dogs and improves lipid profile:**

- ◆ Studies indicated that supplementation of MOS in the diet of dog augmented the cell-mediated immune response and serum lipid profile
- ◆ Cell-mediated immune response, assessed as delayed-type of hypersensitivity response, was significantly higher in the MOS supplemented dogs feed. The percent of lymphocyte sub-populations CD4+ and ratio of CD4+:CD8+ were also significantly higher.
- ◆ Supplementation of MOS also lowered serum total- and LDL- cholesterol levels, in dogs fed MOS supplemented food.

*Reference: Effect of dietary mannanoligosaccharide supplementation on nutrient digestibility, hindgut fermentation, immune response and antioxidant indices in dogs. Journal of Animal Science and Technology (2017) 59:11*

#### **2- MOS increases the population of colonic beneficial bacteria and also prevents binding of pathogenic bacteria:**

- ◆ MOS are components of *Saccharomyces cerevisiae* cell walls and may directly influence colonic bacterial populations by acting as an available substrate (Vickers et al., 2001) or indirectly by influencing the immune system.
- ◆ One proposed mode of action of MOS within the gastrointestinal tract is unique compared with prebiotic oligosaccharides. In addition to directly influencing the population of beneficial bacteria within the colon, MOS also may act indirectly by preventing binding of certain invading bacteria (Shane, 2001). Numerous *Escherichia coli* strains and *Salmonella* species exhibit this mannan-binding behaviour (Spring et al., 2000). Supplemental MOS has been previously shown to affect the immune system of dogs (O'Carra, 1998; Swanson et al., 2002a)

*Reference: GASTROINTESTINAL AND IMMUNOLOGICAL RESPONSES OF SENIOR DOGS TO CHICORY AND MANNAN-OLIGOSACCHARIDES. Archives of Animal Nutrition, December 2004, Vol. 58(6), pp. 483 – 493*





### **3- Role and importance of Yeast Beta-Glucan for dogs**

#### **1- Yeast Beta-Glucan boosts immune response in dogs:**

- ◆ Due to the humanization of pets, owners are looking for additional ways to improve the health and lifespan of their companions. Oral supplementation of  $\beta$ -glucans may be able to support this desire.  $\beta$ -glucans are major structural components of the cell walls of yeast, fungi, and some bacteria. Cereals, such as barley and oat, also contain  $\beta$ -glucans as part of their endosperm cell wall (Volman et al., 2008).
- ◆ Various functional properties have been reported for  $\beta$ -glucans depending on their source and structure (Brown and Gordon, 2005; El Khoury et al., 2012). Cereal  $\beta$ -glucans are linear chains of glucose molecules with b-1,3 and b-1,4 linkages. These  $\beta$ -glucans have been reported to impact intestinal function by acting as a dietary fiber, altering cholesterol metabolism (El Khoury et al., 2012). In contrast, yeast  $\beta$ -glucans are composed of b-1,3 linkages and b-1,6 linked branches which are **known for their ability to modulate the immune system** (Novak and Vetvicka, 2008). Therefore, numerous studies have investigated the effects of yeast  $\beta$ -glucans on immune response (Stuyven et al., 2010; Haladova et al., 2011; Vetvicka and Oliveira, 2014; Vojtek et al., 2017) and cereal  $\beta$ -glucans on intestinal function and diet digestibility in dogs (Ferreira et al., 2018).

*Reference: Evaluation of a yeast  $\beta$ -glucan blend in a pet food application to determine its impact on stool quality, apparent nutrient digestibility, and intestinal health when fed to dogs. Frontiers in Animal Science. 16 January 2023*

#### **2- Beta-glucans have immunomodulation and anti-inflammatory effects helping to improve and prevent atopic dermatitis, inflammatory bowel disease, and osteoarthritis in dogs.**

- ◆ The inclusion of beta-glucans in dog food is associated with numerous beneficial effects on the health of these animals.
- ◆ **Atopic dermatitis**, inflammatory bowel disease, and osteoarthritis are diseases of significant clinical relevance in dogs. In general, the pathophysiology of these chronic conditions is related to immune-mediated and inflammatory mechanisms. Beta-glucans play an important role in improving and prevention of these conditions mostly due to their immunomodulation and anti-inflammatory effects.
- ◆ Additionally, while beta-glucans show promise as a safe supplement, particularly for **osteoarthritis**, further clinical trials are imperative, especially in uncontrolled environments.
- ◆ Beta-glucans emerge as a potential nutraceutical offering immune benefits for **inflammatory bowel disease**, although extensive research is required to define its optimal origin, molecular weight, dosage, and specific applications across animals suffering from this disease.

*Reference: Translating Human and Animal Model Studies to Dogs' and Cats' Veterinary Care: Beta-Glucans Application for Skin Disease, Osteoarthritis, and Inflammatory Bowel Disease Management. Microorganisms 2024, 12, 1071*



## 5- Role and Importance of Enzymes for Pet Health and Well-being

### Classification and functions of common enzymes used in dog feed

- ◆ **Some vets recommend the use of plant and animal enzyme supplements for all pets, including those without exocrine pancreatic insufficiency (EPI). The possible benefits that are expected range from an increase in the digestibility of nutrients to the support of the immune system.**
- ◆ Enzymes can be obtained from animals, plants or microorganisms. Current biotechnological advances allow for the production of biologically active enzymes in large volumes.
- ◆ The addition of enzymes improves the availability of nutrients (starch, proteins, amino acids and minerals, etc.). Additionally, they offer a beneficial performance response most of the time. **The enzymes with carbohydrase, protease, phytase and lipase activities are the most used in the improvement of animal feed.** For its application, it must be ensured that the biocatalyst is capable of resisting feed processing extrusion and **granulation** as well as changes in the gastrointestinal tract.

Common Name	Classification	Function
Amylase	Carbohydrase	Starch Hydrolysis
Cellulase	Carbohydrase	Breaks down cellulose
Lipase	Lipase	Hydrolyzes triglycerides, diglycerides and monoglycerides
Pectinase	Carbohydrase	Breaks down the pectin
Phytase	Phosphatase	Hydrolyse phytate
Protease (Papain)	Protease	Hydrolyzes proteins
Xylanase	Carbohydrase	Hydrolyse xylan
Mannanase	Carbohydrases	Improves digestibility of plant biomass and increases energy.
$\alpha$ -Galactosidase	Carbohydrases	Improves digestibility of plant biomass and increases energy.
$\beta$ -Glucanase	Carbohydrases	Improves digestibility of plant biomass and increases energy.

- ◆ Generally, xylanases are obtained from microorganisms such as *Bacillus* spp. and *Trichoderma reesei*. Xylanases,  $\beta$ -glucanases, pentosanases and phytases not only improve the nutritional quality and viscosity of the diets and productive parameters of the poultry, but also improve the intestinal health of the animal, since they restrict the proliferation of fermentative microorganisms in the small intestine.

Reference: *Exogenous Enzymes as Zootechnical Additives in Animal Feed: A Review. Catalysts* 2021, 11, 851.



## 6- Role and Importance of Amino Acids & Proteins for Pet Health and Well-being

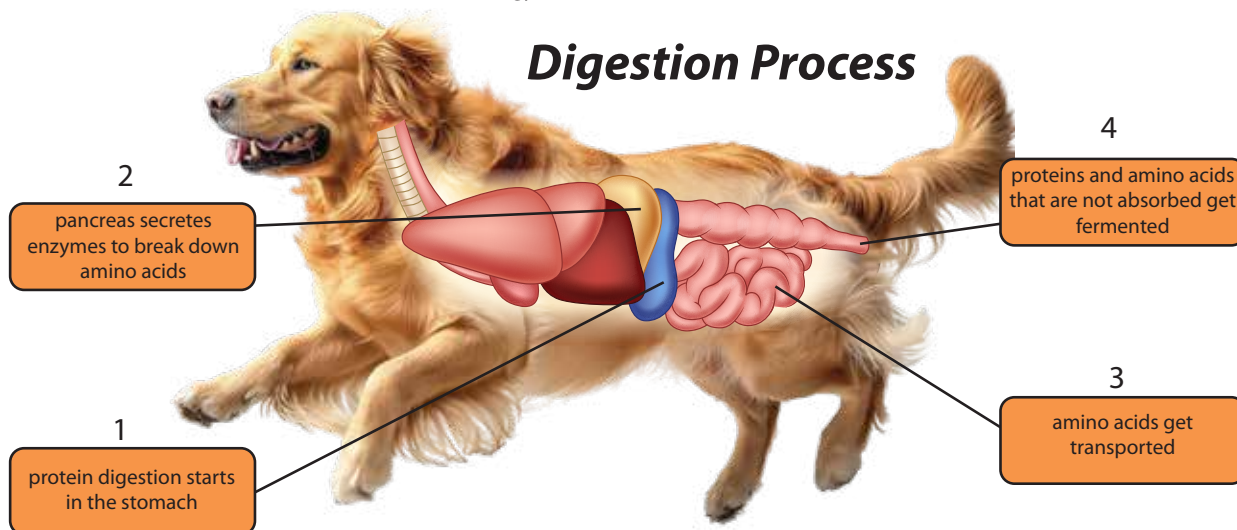
### Amino acids digestibilities in dogs

- ◆ In manufacturing pet foods, the heating of plant-sourced foodstuffs destroys trypsin inhibitors, but prolonged heating decreases the digestibilities of crude protein (CP) and AAs (e.g., Lys and Arg) due to the Maillard reaction.

### Amino acids metabolism and functions in dogs

- ◆ In the liver of dogs, methionine is catabolized to cysteine and then to taurine, but neither taurine nor cysteine is converted to methionine. The rate of oxidation of cysteine to taurine depends on the dietary intakes of sulfur-AAs.
- ◆ Methionine is often the first or the second (after lysine) most limiting AA in plant-based diets for dogs.
- ◆ When fed protein-restricted diets, certain breeds of dogs (e.g., golden retrievers) are more prone to taurine deficiency and the development of dilated cardiomyopathy even when fed meat-based diets due to a combination of factors, including complex interactions among dietary, metabolic, and genetic factors. Only in the breeds of dogs that possess sufficient enzymes for taurine synthesis can the adequate provision of methionine plus cysteine in their diets prevent metabolic diseases such as dilated cardiomyopathy

Reference: Amino acid nutrition and metabolism in domestic cats and dogs. *Journal of Animal Science and Biotechnology* (2023) 14:19





## 7- Role and Importance of Nutraceuticals for Pet Health and Well-being

### Nutraceuticals

- ◆ When a nutritional supplement has medicinal effects, it is called a **“nutraceutical.”** Supplements, such as omega fatty acids, glucosamine, chondroitin sulfates, and methylsulfonylmethane (MSM), have become popular adjunct treatments for arthritis pain in pets.

*Reference: Arthritis. FACT SHEET. Global Veterinary Services*

- ◆ **Nutraceuticals** include glucosamine, chondroitin sulphate/phosphate, methylsulphonylmethane (MSM) and omega 3 fatty acids found in fish oils. These nutrients may be helpful, particularly in the early stages of disease. They may help maintain normal joint fluid and therefore the health of the entire joint, and aid in reducing the inflammation associated with arthritis. Currently, scientific evidence supports omega 3 fatty acids as effective natural anti-inflammatories.

*Reference: CONSERVATIVE MANAGEMENT OF CANINE ARTHRITIS.*

### 1- MSM Powder (important for joint health)

#### 1- MSM as a “cartilage support”

- ◆ MSM, short for methylsulfonylmethane, is a source of organic sulfur, a compound used by cartilage, so it helps to keep cartilage healthier. It has very few side effects.

*Reference: ARTHRITIS TREATMENT OPTIONS. Best Friends Veterinary Center. 2024*

#### 2- MSM works synergistically with glucosamine/chondroitin

- ◆ MSM is a biologically active sulfur compound. Sulfur is another major component of joint cartilage, and MSM is thought to work synergistically with glucosamine/chondroitin to protect cartilage and provide pain relief.

*Reference: DJD/OA DEGENERATIVE JOINT DISEASE/OSTEO-ARTHRITIS. Lake Harriet Veterinary ARTHRITIS TREATMENT OPTIONS. Best Friends Veterinary Center. 2024*





## **2- Chondroprotectants: Glucosamine Sulfate/Chondroitin Sulfate Powder (important for joint support)**

### **1- Glucosamine and chondroitin are chondroprotectants:**

- ◆ Glucosamine and chondroitin are **chondroprotectants**. These supplements help to protect normal joint cartilage. Glucosamine and chondroitin are both precursors of glycosaminoglycans (GAGs). GAGs are a major component of cartilage, so supplemental “building blocks” for GAGs, can help to reduce the rate of degeneration associated with arthritis.

*Reference: DJD/OA DEGENERATIVE JOINT DISEASE/OSTEOARTHRITIS. Lake Harriet Veterinary*

### **2- Glucosamine and chondroitin act as anti-inflammatory agents and help joint lubrication for senior pets:**

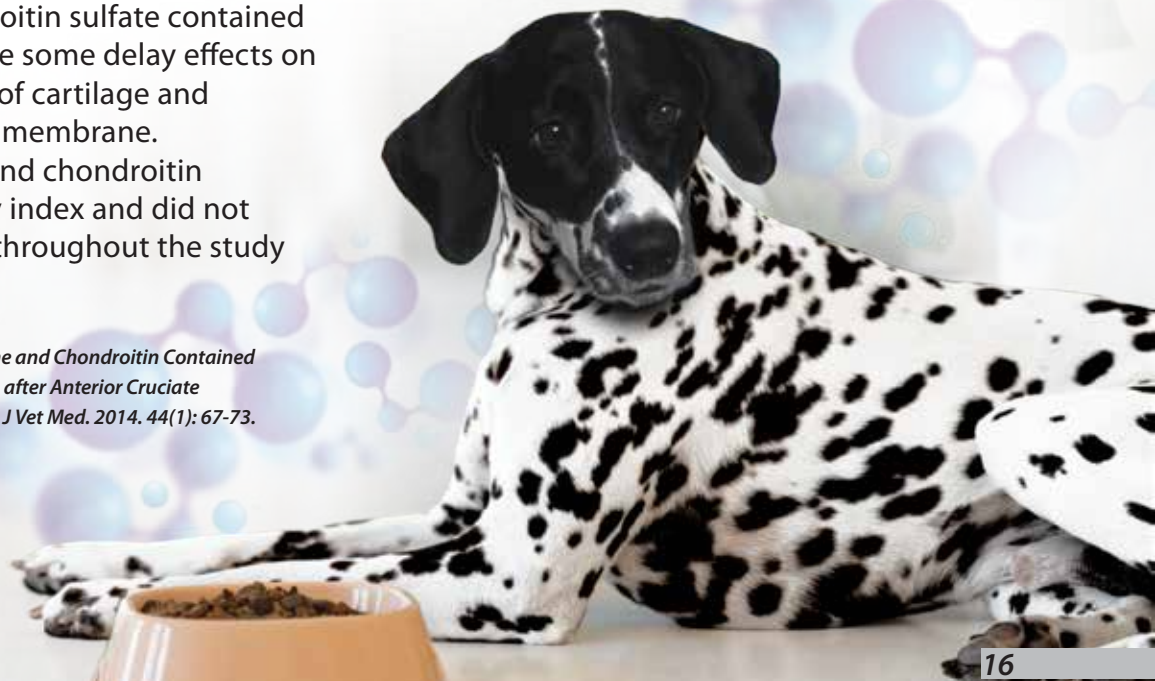
- ◆ These nutritional supplements are recommended for any dog that is a senior, already has arthritis or has had a joint injury or joint surgery. These products supply glycosaminoglycans such as glucosamine and chondroitin. Glycosaminoglycans, or GAGs, decrease inflammation in the joints (and elsewhere). They are also what the body uses to make joint fluid, so giving extra helps keep the joints better lubricated. They have been proven to slow the progression of arthritis. Pets started on these products early (even before symptoms develop) will have slower deterioration in their joints as they age. Many pets with arthritis will have less pain and stiffness when taking these supplements but the primary goal of glucosamine is to prevent or slow joint deterioration, not to treat it once it is there.

*Reference: ARTHRITIS TREATMENT OPTIONS. Best Friends Veterinary Center. 2024*

### **3- Glucosamine and chondroitin are effective and safe:**

- ◆ Glucosamine and chondroitin sulfate contained nutraceutical may provide some delay effects on the degradation process of cartilage and inflammation of synovial membrane. Moreover, glucosamine and chondroitin sulfates had a high safety index and did not show any adverse effect throughout the study period (16 weeks)

*Reference: Clinical Effect of Glucosamine and Chondroitin Contained Nutraceutical on Osteoarthritis in Dogs after Anterior Cruciate Ligament Rupture Surgical Repair. Thai J Vet Med. 2014. 44(1): 67-73.*





## 3- $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) Powder (important for muscle performance)

### 1- HMB improves decreases recovery time from exercise:

- ◆  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB), a metabolite of the amino acid leucine, improves protein balance and muscle performance.

### 2- HMB increases protein retention in muscles:

- ◆ Similar to the amino acid leucine, HMB stimulates mTOR increasing muscle protein synthesis, but HMB also simultaneously decreases muscle protein breakdown resulting in an increase in LBM. This increase in net protein balance could be of particular importance in helping aging canines and/or canines on a protein limited or a limited feed intake diet maintain muscle mass.

### 3- HMB supplementation improves muscle performance in canines:

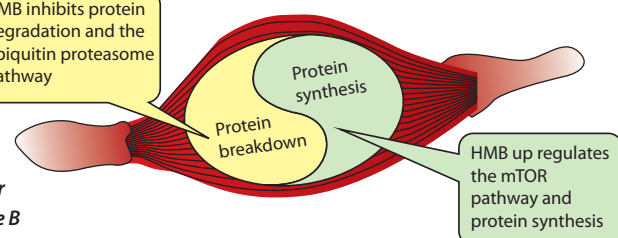
- ◆ Canines, similar to humans, lose muscle and lean body mass (LBM) as a result of sarcopenic and/or cachexic processes.
- ◆ **Sarcopenic muscle loss** is a gradual loss of LBM associated with the aging canine, which many times is accompanied by an increase in fat mass such that total body weight remains unchanged or may even increase. **In the US, 55% of all canines (and 53% of felines) are estimated to be overweight as a result of over consumption of energy relative to expenditure.** The results lead to **further decreases in mobility, exercise, and quality of life** and exacerbation of the obesity problem. Lacking body composition analysis, **the strategy should be to maximize protein synthesis while minimizing fat and weight gains in older animals through proper dietary nutrient intake.**
- ◆ **HMB has been reported to improve aerobic metabolism in muscle by increasing the maximal oxygen consumption (VO<sub>2</sub>max), time to onset of blood lactate accumulation (OBLA), and respiratory compensation point (RCP), and decrease muscle damage shortening recovery time.**

### 4- HMB supplementation reduces muscle damage in canines:

- ◆ HMB supplementation results in measurable decreases in serum creatine phosphokinase (CK, -14.8%) and lactate dehydrogenase (LDH, -25.4%) activities. Less muscle damage means a shorter recovery period for the muscle after an extreme workout.

HMB stimulates protein synthesis (mTOR) while decreasing protein breakdown (ubiquitin proteolytic pathway).

HMB inhibits protein degradation and the ubiquitin proteasome pathway



Reference:  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) Supplementation for Canines. ©2020 Metabolic Technologies LLC, 135 West Main St. Suite B Missoula, MT 59802 877-549-9123



## 4- Turmeric Extract (Curcumin; important as anti-inflammatory and anti-oxidant)

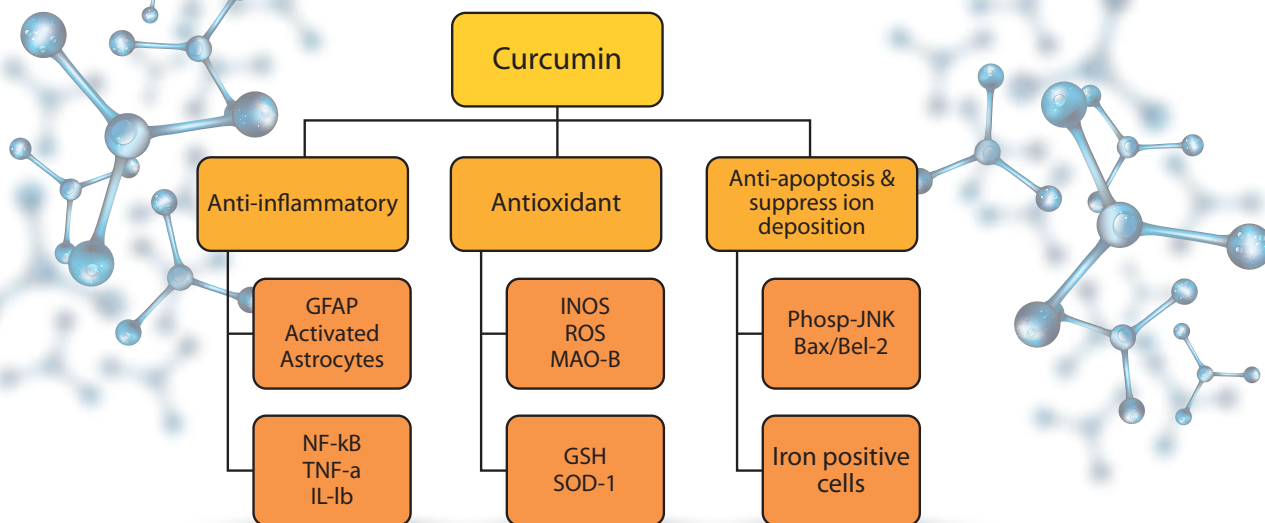
### 1- Curcumin has significant anti-oxidant and anti-inflammatory effects in dogs:

- ◆ Curcumin increases the activity of several antioxidant enzymes in addition to non-protein thiols and the total antioxidant capacity in the serum, consequently reducing levels of oxygen reactive species.
- ◆ Curcumin supplementation of dogs did not favor growth or weight gain. Nevertheless, it was concluded that curcumin improved animal health, with emphasis on the stimulation of the antioxidant system and evidence of an anti-inflammatory effect.

### 2- Curcumin improves feed quality, prolongs the preservation of the feed and stimulates erythropoiesis :

- ◆ Curcumin added to the diet of dogs improves feed quality and prolongs the preservation of the feed by reducing lipoperoxidation and increasing levels of antioxidants.
- ◆ Curcumin also improves canine health by stimulating erythropoiesis and the antioxidant system, possibly by stimulating protective effects on the liver.

Reference: Dog food production using curcumin as antioxidant: effects of intake on animal growth, health and feed conservation. Archives of Animal Nutrition. 2020



Reference: Turmeric and Its Major Compound Curcumin on Health: Bioactive Effects and Safety Profiles for Food, Pharmaceutical, Biotechnological and Medicinal Applications. Frontiers in Pharmacology. September 2020, Volume 11, Article 01021



## **5- Conjugated Linoleic Acid (CLA) Powder (important for fat metabolism and energy production)**

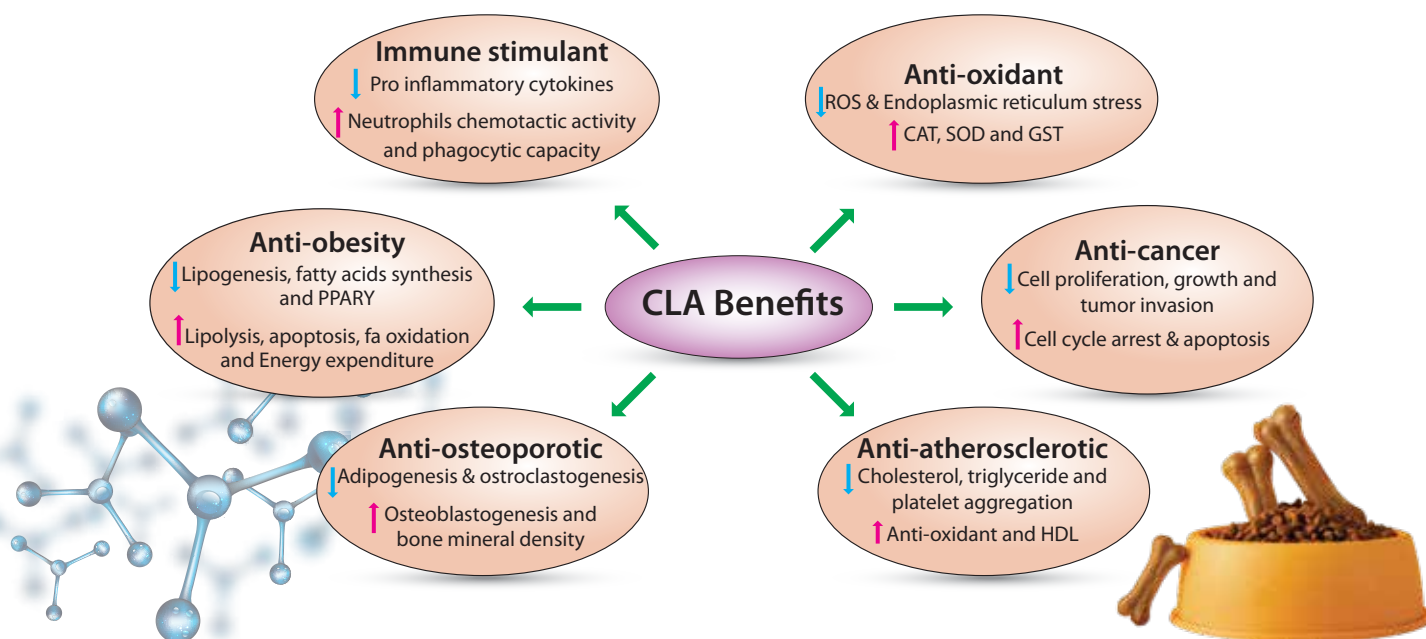
### **1- The inclusion of the conjugated linoleic acid (CLA) in food for dogs results in higher values of metabolizable energy:**

- ◆ The inclusion of the conjugated linoleic acid (CLA) in food for dogs has been displaying great potential, taking into account several benefits in regard to the use of this product.
- ◆ The coefficients of apparent digestibility of the dry matter, crude protein, etheral extract and nitrogen-free extract were not affected by the inclusion of conjugated linoleic acid, showing that the addition of the product did not interfere with the process of digestion of nutrients.
- ◆ In digestibility experiments, higher values of metabolizable energy were observed for the diets with inclusion of CLA when compared with non-CLA containing diet.

### **2- CLA helps to reduce body fat accumulation in dogs:**

- ◆ Some works have been showing smaller deposition of body fat, in animal and human models receiving diets supplemented with CLA. The increase of the energy metabolism induced by CLA is one of the several mechanisms suggested to explain the reduction of the body fat.

*Reference: DIGESTIBILITY OF NUTRIENTS WITH THE INCLUSION OF CONJUGATED LINOLEIC ACID IN THE DIET OF DOGS. Archives of Veterinary Science v.12, n.1, p. 52- 57, 2007*





## 6- Omega 3, 6, 9 (important for skin, coat and cognition)

### 1- Importance of fats and fatty acids for dogs:

◆ Dietary fats, as well as specific fatty acids, are essential in the diet of dogs, as recognized in the nutrient recommendations for pet food provided by the National Research Council (NRC) and the Association of American Feed Control Officials (AAFCO).

◆ **Fats and fatty acids:**

- 1- Provide energy
- 2- Aid in fat-soluble vitamin absorption
- 3- Modulate inflammation
- 4- Act as a precursor to eicosanoids and prostaglandins
- 5- Serve structural roles as a component of cell membranes
- 6- Promote healthy growth and development
- 7- Affect skin and coat health.

◆ The type of fatty acids fed to a patient, as well as the total amount of fatty acids in the diet, have the additional potential to improve or impair health.

### 2- Types of “Omegas” required by dogs:

- ◆ Fatty acids with double bonds are called omega-9, omega-6, or omega-3 based on the location of the first double bond from the methyl (omega) end of the hydrocarbon chain.
- ◆ For example, omega-6 fatty acids, often found in animal tissue and in sunflower and safflower oils, have their first double bond between carbons 6 and 7 from the omega end, whereas omega-3 fatty acids, derived from plant and marine sources, have their first double bond between carbons 3 and 4.

### Essential Fatty Acids with Numeric Formula

COMMON NAME (Abbreviation)	NUMERIC FORMULA (chain length: double bonds)	LOCATION OF FIRST DOUBLE BOND (relative to omega end of chain)
Linoleic acid (LA)	18:2	Omega-6
Alpha-linolenic acid (ALA)	18:3	Omega-3
Arachidonic acid (AA)	20:4	Omega-6
Eicosapentaenoic acid (EPA)	20:5	Omega-3
Docosahexaenoic acid (DHA)	22:6	Omega-3

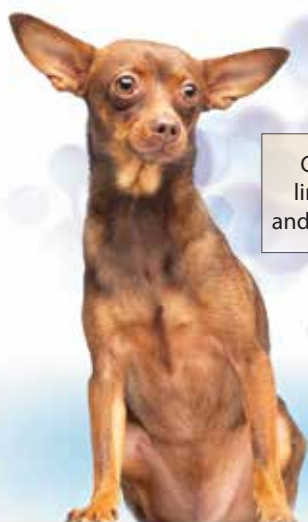
Reference: ROLE OF DIETARY FATTY ACIDS IN DOGS & CATS. TODAY'S VETERINARY PRACTICE | September/October 2016



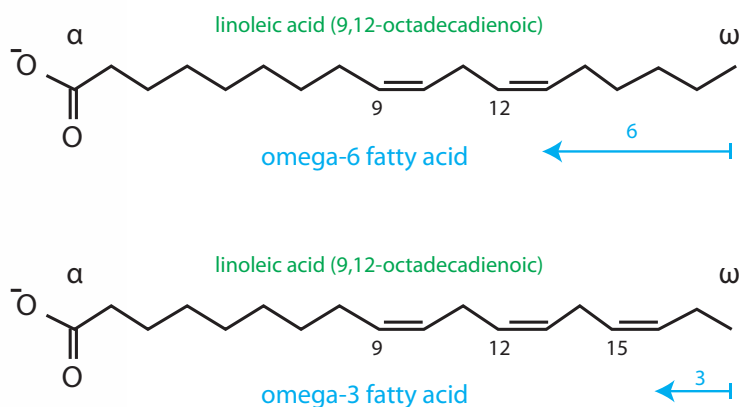
### 3- Value of omegas fatty acids for dogs:

Fatty acids, especially EPA and DHA, have a number of therapeutic uses in dogs include:

- 1- Supplemental fish oil is used as adjunctive therapy for **inflammatory** conditions, such as inflammatory **skin disease and osteoarthritis, cancer, hyperlipidemia, and cardiac** disease.
- 2- DHA is supplemented in growth diets to support optimal retinal function and neuronal development.
- 3- Supplementation with fatty acids, including LA and EPA/DHA, is used to treat dermatologic disease.



Chemical structure of linoleic acid (omega-6) and linoleic acid (omega-3)



Reference: *ROLE OF DIETARY FATTY ACIDS IN DOGS & CATS. TODAY'S VETERINARY PRACTICE* | September/October 2016

## 7- Betaine (important for renal health)

### 1- Importance of betaine for dogs with renal diseases:

- ◆ Renal diets are recommended for dogs with chronic kidney disease (CKD). Several studies have shown anti-inflammatory properties of betaine (trimethylglycine) in addition to its roles as a methyl group donor and osmoprotectant. In addition, supplementation with betaine reduced levels of serum uric acid and improved kidney function in a hyperuricemic mouse model.
- ◆ Overall, foods with added betaine and soluble fiber showed positive effects on the plasma and fecal metabolomes.

Reference: *Effect of Added Dietary Betaine and Soluble Fiber on Metabolites and Fecal Microbiome in Dogs with Early Renal Disease. Metabolites* 2020, 10, 0370



## 8- Role and Importance of Acidifiers and pH Buffers for Pet Health and Well-being

### 1- Role and importance of organic acids

- ◆ **Sorbic acid** is used to inhibit the growth of mold, yeast, and some bacteria, extending the shelf life of dry dog food. It's effective in low concentrations and is considered safe for pets when used within regulatory limits.
- ◆ **Formic acid** is used to control microbial growth, particularly in preventing spoilage in dry pet food. It can also lower the pH of the food, creating an environment less favorable for pathogens.
- ◆ **Phosphoric acid** helps regulate the acidity of dry dog food, improving palatability and aiding in the preservation process. It can also contribute to phosphorus levels, an essential mineral for dogs, supporting bone health.
- ◆ **Citric acid** acts as a natural preservative by lowering pH and inhibiting microbial growth. It enhances the flavor profile, making food more appealing to dogs, and works synergistically with antioxidants like ascorbic acid to protect fats and oils from oxidation, maintaining nutritional quality.
- ◆ **Ascorbic acid** is primarily used as an antioxidant to prevent oxidative rancidity in the fats and oils of dry dog food, extending shelf life. While dogs can synthesize their own vitamin C, small amounts in food may support immune function or act as a natural preservative in premium formulations.
- ◆ **Lactic acid** lowers the pH of dry dog food, inhibiting microbial growth and enhancing shelf life. It can also improve palatability by adding a slight tangy flavor, which dogs may find appealing. It's naturally produced during fermentation, making it suitable for "natural" pet food products.

### 2- Role and importance of disodium EDTA

- ◆ The use of EDTA and its salts as stabilizing and chelating agents has been described as "ubiquitous" (Rietschel and Fowler 1995).
- ◆ In foods, EDTA is an antioxidant (NTP 1998); Disodium EDTA is a preservative, sequestrant, and stabilizer.
- ◆ Disodium EDTA is permitted in the feed and drinking water of animals and/or for the treatment of food-producing animals (Sax 1979).
- ◆ EDTA and the Edetates prevent discoloration due to trace metals in antibiotics, antihistamines, and local anesthetics. They are used to stabilize solutions of ascorbic acid (vitamin C), hydrogen peroxide, formaldehyde, folic acid, and hyaluronidase (Hall and Takahashi 1988; Rietschel and Fowler 1995).

*Reference: Final Report on the Safety Assessment of EDTA, Calcium Disodium EDTA, Diammonium EDTA, Dipotassium EDTA, Disodium EDTA, TEA-EDTA, Tetrasodium EDTA, Tripotassium EDTA, Trisodium EDTA, HEDTA, and Trisodium HEDTA. International Journal of Toxicology, 21(Suppl. 2):95-142, 2002*



# AMPHI-PET

*Maximum Strength  
nanoemulsion spray*

*Advanced nanoemulsion liquid additive designed to fortify dry or wet pet food with essential nutrients including vitamins, minerals, probiotics, prebiotics, amino acids, nutraceuticals and immune boosters for optimal health and well-being.*

## **Composition**

**Each 100 ml of AmphiPET Maximum Strength spray contains:**

### **1- Vitamins**

- 1- Ascorbic Acid (Vitamin C)
- 2- Vitamin A (Retinyl acetate)
- 3- Vitamin E (dl- $\alpha$ -Tocopheryl acetate)
- 4- Mixed Tocopherols
- 5- Folic Acid
- 6- Vitamin B1 (Thiamine)
- 7- Vitamin B12 (Cobalamin)
- 8- Vitamin B2 (Riboflavin)
- 9- Vitamin B3 (Niacin)
- 10- Vitamin B5 (Calcium Pantothenate)
- 11- Vitamin B6 (Pyridoxine HCl)
- 12- Vitamin K<sub>3</sub> (Menadione)
- 13- Vitamin D<sub>3</sub> (Cholecalciferol)
- 14- Choline Chloride  
(vitamin-like quaternary ammonium essential nutrient)

### **2- Minerals (Chelated)**

- 1- Chelated Zinc
- 2- Chelated Copper
- 3- Chelated Manganese
- 4- Chelated Iron
- 5- Selenium Glycinate
- 6- Magnesium Glycinate
- 7- Potassium Iodide
- 8- Potassium Citrate

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### **3- Probiotics**

- 1- Enterococcus faecium
- 2- Lactobacillus acidophilus
- 3- Bacillus licheniformis
- 4- Bacillus coagulans
- 5- Lactobacillus plantarum
- 6- Bacillus subtilis

### **4- Prebiotics**

- 1- FOS (Fructo-oligosaccharide)
- 2- MOS (Mannan Oligosaccharide)
- 3- Beta Glucan

### **5- Enzymes**

- 1- Protease (Papain)
- 2- Lipase
- 3- Amylase
- 4- Mannanase
- 5-  $\alpha$ -Galactosidase
- 6-  $\beta$ -Glucanase
- 7- Pectinase
- 8- Phytase
- 9- Xylanase
- 10- Cellulase

### **6- Amino Acids & Proteins**

- 1- Methionine
- 2- Lysine
- 3- Taurine Amino Acid Powder
- 4- Amino Acid Mix (80%)
- 5- Protein Peptides
- 6- Collagen Peptides Powder

### **7- Nutraceuticals**

- 1- MSM Powder
- 2- Glucosamine Sulfate Powder
- 3- Chondroitin Sulfate Powder
- 4- HMB Powder
- 5- Turmeric Extract (Curcumin)
- 6- CLA Powder
- 7- Omega 3, 6 and 9
- 8- Betaine HCl

### **8- Preservatives, Stabilizers and Antioxidants**

- 1- Sorbic Acid
- 2- Formic Acid
- 3- Phosphoric Acid (75%)
- 4- Citric Acid (anhydrous)
- 5- Ascorbic Acid (Vitamin C)
- 6- Ascorbyl Palmitate
- 7- Tartaric Acid
- 8- Lactic Acid
- 9- Disodium EDTA

### **9- Carrier & Delivery System**

- 1- Water-Oil Emulsion Carrier
- 2- Polyethylene Glycol
- 3- Food-grade Dextrin
- 4- MCT Oil

### **10- Flavoring Agents**

- 1- Natural Salmon Flavor

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*Advanced nanoemulsion liquid additive designed to fortify dry or wet pet food with essential nutrients including vitamins, minerals, probiotics, prebiotics, amino acids, nutraceuticals and immune boosters for optimal health and well-being.*

## **Product Description**

- ◆ **AmphiPET Maximum Strength spray** is designed to be **sprayed directly on dry food kibbles or mixed with wet pet food, providing essential probiotics, enzymes, prebiotics, vitamins, minerals, and amino acids** that support your pet's digestive health, immune system, and overall vitality.
- ◆ **AmphiPET Maximum Strength spray** is a premium liquid feed additive, manufactured using cutting-edge **nanoemulsion technology** to ensure superior **bioavailability, rapid absorption and enhanced palatability**.
- ◆ **AmphiPET Maximum Strength spray** allows **incorporating nanomaterials into animal feed leading to improved animal growth, better-feed utilization and more efficient nutrient conversion. In addition, nanomaterials can help improve digestion & absorption of nutrients in animals, resulting in better overall metabolism & physiology.** This advanced formulation ensures that your pet receives the full benefit of each carefully selected component, even in small doses.
- ◆ **AmphiPET Maximum Strength spray**, by applying **nano-emulsified particles** have a significantly **larger surface area, facilitating faster digestion and uptake through the intestinal lining.** This is particularly beneficial for animals with compromised gut health, weak digestion, or during recovery. **The result is faster action, improved nutrient delivery, and greater physiological impact compared to conventional feed additives.**
- ◆ **AmphiPET Maximum Strength spray**, by applying **nanoencapsulation technique**, probiotics are dispersed into outer coats to shield them from environmental conditions.
- ◆ **AmphiPET Maximum Strength spray** provides a **probiotic mixture** including **Bacillus subtilis and Bacillus licheniformis** improving the fecal score, reducing nitrogen fermentation products in feces, and reducing fecal odor in dogs.
- ◆ **AmphiPET Maximum Strength spray** provide **multistrain probiotics** proved to improve clinical remission, suppress inflammation, and increase epithelial barrier function in dogs diagnosed with **IBD**.



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- ◆ **AmphiPET Maximum Strength spray** provide **multistrain probiotics** well known to accelerate clinical recovery and intestinal microbiota normalization in dogs with acute hemorrhagic diarrhea.
- ◆ **AmphiPET Maximum Strength spray** contains **MOS prebiotic** known to boost cell-mediated immune response in dogs and improves lipid profile. It helps also increase the population of colonic beneficial bacteria and also prevents binding of pathogenic bacteria in dogs.
- ◆ **AmphiPET Maximum Strength spray** contains **beta-glucan yeast (immune active compound extracted from *S. cerevisiae*)** that allows better intestinal immune functions through increased the abundance of Turicibacter, decreased the abundance of E. coli, increased fecal butyrate, and shifted the microbial functional gene profile in healthy adult beagle dogs.
- ◆ **AmphiPET Maximum Strength spray** contains **multiple vitamins and chelated minerals** that help maintain essential metabolic functions in dogs and prevent deficiency disorders.
- ◆ **AmphiPET Maximum Strength spray** contains **essential anti-oxidants** such as ascorbic acid (vitamin C), vitamin E and mixed tocopherols.
- ◆ **AmphiPET Maximum Strength spray** contains **numerous nutraceuticals, each has its own importance for dog's health.** These include:
  - 1- MSM Powder (for joint health)
    - ◆ MSM as a "cartilage support". MSM works synergistically with glucosamine/chondroitin.
  - 2- Glucosamine/Chondroitin Sulfate Powder (for joint support)
    - ◆ Glucosamine and chondroitin are chondroprotectants for healthy joints. They act as anti-inflammatory agents and help joint lubrication for senior pets.
  - 3- HMB Powder (for muscle performance)
    - ◆ Supplemental HMB improves muscle performance and decreases recovery time from exercise, HMB increases protein retention in muscles. HMB supplementation improves muscle performance in canines also, reduces muscle damage in canines.



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## **Product Description (cont.)**

- 4- Turmeric Extract (Curcumin; anti-oxidant and anti-inflammatory)
  - ◆ Curcumin has significant anti-oxidant and anti-inflammatory effects in dogs. Curcumin improves feed quality, prolongs the preservation of the feed and stimulates erythropoiesis.
- 5- Conjugated linoleic acid (CLA) Powder (for proper fat metabolism)
  - ◆ The inclusion of the conjugated linoleic acid (CLA) in food for dogs results in higher values of metabolizable energy. CLA helps to reduce body fat accumulation in dogs.
- 6- Omega 3, 6, 9 (for healthy skin, coat an better cognition and vision)
  - ◆ "Omegas" provide energy, aid in fat-soluble vitamin absorption, modulate inflammation, act as a precursor to eicosanoids and prostaglandins, serve structural roles as a component of cell membranes, promote healthy growth and development, affect skin and coat health
- 7- Betaine is required for renal health.

## **Product Benefits**

### **1- AmphiPET Maximum Strength spray helps support digestive health:**

- ◆ The multi-strain probiotics (Bacillus spp., Lactobacillus spp., Enterococcus faecium) help establish a healthy gut flora, reduce harmful bacteria, improve nutrient absorption, and enhance stool consistency.
- ◆ Digestive enzymes like amylase, lipase, cellulase, and protease assist in breaking down complex carbohydrates, fats, fibers, and proteins, improving feed efficiency and reducing gastrointestinal load.

### **2- AmphiPET Maximum Strength spray helps improve symptoms of IBS in dogs:**

- ◆ The multi-strain probiotics proved to improve clinical remission, suppress inflammation, and increase epithelial barrier function in dogs diagnosed with IBD.

### **3- AmphiPET Maximum Strength spray helps accelerate clinical recovery of acute hemorrhagic diarrhea in dogs.**

- ◆ The multi-strain probiotics proved to accelerates clinical recovery and intestinal microbiota normalization in dogs with acute hemorrhagic diarrhea.



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**4- AmphiPET Maximum Strength spray can boost immune function & inflammation control:**

- ◆ Yeast beta-glucans and MOS (Mannan-oligosaccharides) act as immune modulators, enhancing innate defense mechanisms while also binding and removing pathogenic bacteria like E. coli and Salmonella.
- ◆ Vitamin C, Vitamin E, and mixed tocopherols work as potent antioxidants, protecting tissues from oxidative stress and supporting recovery during illness.

**5- AmphiPET Maximum Strength spray helps as neurological & metabolic support:**

- ◆ The B-complex vitamins (B1–B12) are essential for energy metabolism, nerve conduction, neurotransmitter synthesis, and stress management.
- ◆ Choline and betaine play key roles in liver function, fat metabolism, and neurotransmission, especially important for senior or stressed animals.

**6- AmphiPET Maximum Strength spray may be essential for skeletal & muscular development:**

- ◆ Chelated minerals (zinc, manganese, copper, iron) are provided in a highly bioavailable form for better bone development, wound healing, enzyme function, and oxygen transport.
- ◆ Vitamin D<sub>3</sub> supports calcium absorption and bone integrity, while vitamin K<sub>3</sub> helps in blood clotting and bone protein activation.

**7- AmphiPET Maximum Strength spray helps skin, coat & cellular health:**

- ◆ Vitamin A supports epithelial repair, vision, and immune barrier function.
- ◆ Zinc and vitamin E promote skin integrity, faster healing, and a glossy coat.
- ◆ Essential amino acids like lysine and methionine are required for protein synthesis, muscle maintenance, and immune responses.

**8- AmphiPET Maximum Strength spray helps growth & recovery:**

- ◆ The presence of protein peptides and a concentrated amino acid mix enhances muscle repair, tissue regeneration, and supports growth in young pets or recovery in ill animals.

**9- AmphiPET Maximum Strength spray is used for dogs of all ages.**

- ◆ **It is recommended** during periods of stress, digestive upset, antibiotic therapy, food changes, or to enhance general well-being.



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## **Product Benefits (cont.)**

**10- *AmphiPET Maximum Strength spray* is used for improving and prevention of atopic dermatitis, inflammatory bowel disease, and osteoarthritis in dogs.**

◆ Beta-glucans play an important role immunomodulation and anti-inflammatory effects.

**11- *AmphiPET Maximum Strength spray* may be used to improve diabetic control in pets.**

**Essential anti-oxidants** such as ascorbic acid (vitamin C), vitamin E and mixed tocopherols may help as anti-diabetics for Pets

**12- *AmphiPET Maximum Strength spray* may be used to guard against cardiomyopathy in dogs:**

◆ Amino acids methionine and lysine are required to prevent taurine deficiency that may be responsible for such case

**13- *AmphiPET Maximum Strength spray* may be of value for aging dogs:**

◆ Essential amino acids of *AmphiPET Maximum Strength* are required to alleviate aging-associated reductions in the mass and function of muscles and bones

**14- *AmphiPET Maximum Strength spray* includes several omegas.**

◆ They, especially EPA and DHA, have a number of therapeutic uses in dogs include:

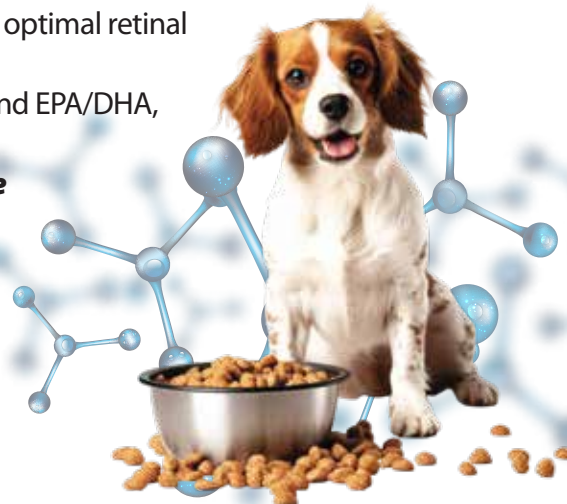
1- Supplemental fish oil is used as adjunctive therapy for inflammatory conditions, such as inflammatory skin disease and osteoarthritis, cancer, hyperlipidemia, and cardiac disease.

2- DHA is supplemented in growth diets to support optimal retinal function and neuronal development.

3- Supplementation with fatty acids, including LA and EPA/DHA, is used to treat dermatologic disease.

**15- *AmphiPET Maximum Strength spray* contains betaine helpful in renal diseases:**

◆ Betaine has anti-inflammatory properties. Betaine reduces levels of serum uric acid and improves kidney function in cases of hyperuricemia.





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**16- AmphiPET Maximum Strength spray may have these benefits in general:**

- ◆ Enhances Digestion: Rich enzyme blend improves the breakdown of food for optimal nutrient absorption.
- ◆ Supports Gut Health: High-potency probiotics and prebiotics promote a balanced gut microbiome.
- ◆ Boosts Immunity: Includes immune-stimulating components like yeast beta-glucans & vitamins.
- ◆ Promotes Growth & Vitality: Enriched with essential amino acids and chelated minerals.
- ◆ Improves Skin & Coat: With vitamins A, D<sub>3</sub>, and E plus chelated zinc.
- ◆ Anti-Stress & Recovery Support: B-vitamin complex and choline support nervous system and recovery.

## **Dosage & Directions for Use**

**Method of Application :**

- ◆ Spray directly on your pet's dry food kibbles before feeding.
- ◆ Shake well before use. Ensure food is evenly coated with the spray.

**Recommended Daily Dose:**

- ◆ Small Pets (<10 kg): 0.5 – 1 ml
- ◆ Medium Pets (10–25 kg): 1 – 2 ml
- ◆ Large Pets (>25 kg): 2 – 3 ml

## **Storage & Caution**

- ◆ Store in a cool, dry place away from sunlight.
- ◆ Keep out of reach of children.
- ◆ For animal use only. Not for human consumption.
- ◆ Use within 60 days after opening.
- ◆ Do not exceed the recommended dose unless advised by a veterinarian.



# AMPHI-PET

Maximum Strength  
nanoemulsion spray

*Advanced nanoemulsion liquid additive designed to fortify dry or wet pet food with essential nutrients including vitamins, minerals, probiotics, prebiotics, amino acids, nutraceuticals and immune boosters for optimal health and well-being.*

## YOUR PRECIOUS PET DESERVES THE BEST



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