FUTURE PET NUTRITION: RESEARCH

PROTEIN BOOST

1. Krill Omega 3 Powder	40/100 grams
2. Egg Protein	25/100 grams.
3. Creatine	20/100 grams.
4. Taurine	07/100 grams.
5. Leucine	03/100 grams
6. White Kidney Bean Extract	02/100 grams
7. Aspergillus Niger Fermentation Blend	02/100 grams
8. Beef Flavouring	01/100 grams.

1. <u>Krill Omega 3 Powder</u> 40/100 grams (about 20%).

Krill are small, pink and opaque Arctic marine crustaceans that feed on phytoplankton, microscopic, single-celled plants that drift near the ocean's surface and live off carbon dioxide and the sun's rays. The pink colour of krill and the reddish brown colour of krill powder is caused by an aquatic carotenoid called Astaxanthin, which the Krill gets from its diet.

1.1 Source of High Quality 83% Bio-available Protein with Excellent Amino Acid Profile.

1.2 Superior source of Omega 3 and Fatty Acids.

1.3 Excellent Source of Minerals

- Calcium 2.5%
- Phosphorus 1.55%
- Iron 57.2 ppm
- Copper 74 ppm
- Zinc 71.8 ppm
- 71.8 ppm
- Sodium 0.8%
- Potassium 0.4%
- Magnesium 0.4%
- Nickel 2.9 ppm
- Chromium 0.4 ppm
- Manganese 5.4 ppm
- Cobalt 1.4 ppm
- Selenium 12.5 ppm
- Aluminium 65.8 ppm

1.4 Omega 3's, Found Abundantly in Krill are Anti-carcinogenic

<u>The long chain Omega 3 poly-unsaturated fatty acids(n-3 PUFAs) eicosapentaenoic acid (EPA) and its metabolite, docosahexaenoic acid,</u>

inhibit cancer formation. (Omega-3 polyunsaturated fatty acids selectively inhibit growth in neoplastic oral keratinocytes by differentially activating ERK1/2 Zacharoula Nikolakopoulou, Georgios Nteliopoulos, Adina Teodora Michael-Titus and Eric Kenneth Parkinson

1.5 Astaxanthin is a Super Nutrient and the Most Powerful Natural Anti-oxidant on the Planet.

Astaxanthin is the most potent carotenoid antioxidant when it comes to free radical scavenging, 65 times more powerful than vitamin C, 54 times more powerful than beta-carotene, and 14 times more powerful than vitamin E.

Astaxanthin is nature's most powerful anti-oxidant in respect of singlet, oxygen quenching. Exponentially more so than beta-carotene (11 x stronger), alpha lipoic acid (75 x stronger), green tea catechins and Vitamin E (550 x stronger), Coenzyme Q 10 (800 x stronger), Vitamin C (6000 x stronger), etc.

(Carotenoid Science, Vol.11, 2007, 16-20 ISSN 1880-5671 ***Quenching Activities of Common Hydrophilic and Lipophilic Antioxidants against Singlet Oxygen Using Chemiluminescence Detection System*** Yasuhiro Nishida*, Eiji Yamashita and Wataru Miki)

"Living organisms possess defense mechanisms against oxidative damage. One of the most important ways is using anti-oxidants, such as ascorbic acid (Vit C), polyphenols, Coenzyme Q10 (CoQ10), tocopherols or carotenoids, for quenching and/or scavenging against reactive oxygen species (ROS).

Singlet oxygen (1O2) is a non-radical reactive oxygen species (ROS) with one of the strongest activities. It directly damages biological lipids, proteins and DNA, which damage is then related to serious diseases such as diabetes, hypertension and cancer.

The substances that were tested were all common hydrophilic and lipophilic antioxidants such as polyphenols, tocopherols, carotenoids, ascorbic acid, coenzyme Q10 and α-lipoic acid.

Overall, astaxanthin exhibited the most potent singlet oxygen quenching activity among the compounds tested in this study because it showed a stable superior property under the three different conditions."

See the excellent graph on page 20 of the study below?

http://www.cyanotech.com/pdfs/bioastin/batl40.pdf

Astaxanthin crosses the blood-brain barrier and the blood-retinal barrier, whilst beta-carotene and lycopene does not. This brings anti-oxidant and anti-inflammatory protection to eyes, the brain and to the central nervous system.

Astaxanthin is soluble in fats and is therefore incorporated into cell membranes.

1.6 Astaxanthin Improves Skin Elasticity, Skin Aging and Protects Skin from Sun Damage

Astaxanthin comes from algae called *hamotococcus pluvialis* (*h. pluvialis*), which the Krill eats. *H. pluvialis* drifts close to the ocean surface and Astaxanthin protects it from ultra violet radiation that it is constantly exposed to.

Astaxanthin is found in most organs in the body, but it accumulates in the skin, and in all the skin layers. Topical sunscreens can reach only the outermost layers.

Ultraviolet radiation is the most serious environmental risk factor for skin cancer.
Exposure of lipids and tissues to light, especially UV-light, can lead to production of singlet oxygen and free radicals and photo-oxidative damage of these lipids and tissues. Excessive exposure of unprotected skin to sunlight results in sunburn and can also lead to photo-induced oxidation, inflammation, immune-suppression, aging and even carcinogenesis of skin cells.

Astaxanthin enables longer UV radiation exposure/reduces the risk of sunburn and, if UV damage does occur, Astaxanthin materially diminishes inflammation, photo immune-suppression, photo aging and the chances of skin cancer development. **(**Wei Sheng Yan Jiu. 2011 Sep;40(5):551-4. ***Protective effects of astaxanthin against oxidative damage induced by 60Co gamma-ray irradiation.*** Zhao W1, Jing X, Chen C, Cui J, Yang M, Zhang Z)

See also the very detailed research article called ***Haematococcus astaxanthin: applications for human health and nutrition*** Martin Guerin, Mark E. Huntley and Miguel Olaizola below at:

http://www.cyanotech.com/pdfs/bioastin/batl09.pdf

See also ***Cosmetic benefits of astaxanthin on humans subjects*** Kumi Tominaga, Nobuko Hongo, Mariko Karato and Eiji Yamashita:

Two human clinical studies were performed. One was an open-label non-controlled study involving 30 healthy female subjects for 8 weeks. Significant improvements were observed by combining 6 mg per day oral supplementation and 2 ml (78.9 μM solution) per day topical application of Astaxanthin. Astaxanthin showed improvements in skin wrinkle (crow's feet at week-8), age spot size (cheek at week-8), elasticity (crow's feet at week-8), skin texture (cheek at week- 4), moisture content of corneocyte layer (cheek in 10 dry skin subjects at week-8) and corneocyte condition (cheek at week-8). It may suggest that Astaxanthin can improve skin condition in all layers such as corneocyte layer, epidermis, basal layer and dermis by combining oral supplementation and topical treatment.

Another study was a randomized double-blind placebo controlled study involving 36 healthy male subjects for 6 weeks. Crow's feet wrinkle and elasticity and trans-epidermal water loss (TEWL) were improved after 6 mg of Astaxanthin (the same as former study) daily supplementation. Moisture content and sebum oil level at the cheek zone showed strong improvement.

1.7 Astaxanthin Boosts the Immune Function

Immune response cells are particularly sensitive to oxidative stress and membrane damage by free radicals because they rely heavily on cell-to-cell communications via cell membrane receptors.

The phagocytic action (engulfing and absorbing bacteria and other small cells and particles) of some of these cells releases free radicals that can rapidly damage these cells if they are not neutralized by antioxidants such as Astaxanthin.

1.8 Astaxanthin Prevents cancer

Epidemiological studies reveal that dietary intake of Astaxanthin along with other carotenoids is associated with the reduced risk of many different types of cancer.

Unlike many pharmaceuticals, Astaxanthin shows beneficial effects against cancer at each stage of its development:

- It pro-actively prevents cancer from starting by protecting DNA from ultraviolet and oxidant damage.
- It promotes early detection and destruction of cells that have undergone malignant transformation by boosting immune surveillance. (Yuan JP, Peng J, Yin K, Wang JH. ***Potential health-promoting effects of astaxanthin: a high-value carotenoid mostly from microalgae.*** *Mol Nutr Food Res*. 2011 Jan;55(1):150-65.)
- It prevents cancerous growth in cells that evade immune detection by reducing inflammatory changes such as those that appear in aging. (Yasui Y, Hosokawa M, Mikami N, Miyashita K, Tanaka T. ***Dietary astaxanthin inhibits colitis and colitis-associated colon carcinogenesis in mice via modulation of the inflammatory cytokines.*** *Chem Biol Interact*. 2011 Aug 15;193(1):79-87.

Nagendraprabhu P, Sudhandiran G. ***Astaxanthin inhibits tumor invasion by decreasing extracellular matrix production and induces apoptosis in experimental rat colon carcinogenesis by modulating the expressions of ERK-2, NFkB and COX-2.*** *Invest New Drugs*. 2011 Apr;29(2):207-24.

- Astaxanthin blocks the rapid cell replication of tumors in their growth phase by stopping the cancer cells' reproductive cycle and by restoring cancer cells' ability to die off by apoptosis (normal cellular death in the progress of time).

  Palozza P, Torelli C, Boninsegna A, et al. ***Growth-inhibitory effects of the astaxanthin-rich alga Haematococcus pluvialis in human colon cancer cells.*** *Cancer Lett*. 2009 Sep 28;283(1):108-17.

  Song XD, Zhang JJ, Wang MR, Liu WB, Gu XB, Lv CJ. ***Astaxanthin induces mitochondria-mediated apoptosis in rat hepatocellular carcinoma CBRH-7919 cells.*** *Biol Pharm Bull*. 2011;34(6): 839-44.

  Zhang X, Zhao WE, Hu L, Zhao L, Huang J. ***Carotenoids inhibit proliferation and regulate expression of peroxisome proliferators-activated receptor gamma (PPARgamma) in K562 cancer cells.*** *Arch Biochem Biophys*. 2011 Aug 1;512(1):96-106.

  Song X, Wang M, Zhang L, et al. Changes in cell ultrastructure and inhibition of JAK1/STAT3 signaling pathway in CBRH-7919 cells with astaxanthin. *Toxicol Mech Methods.* 2012 Nov;22(9): 679-86.

2. <u>Egg Protein</u> **25/100 grams**

Whole egg is the 100% standard against which the bioavailabilty of proteins are measured. Apart from the egg protein being 100% bioavailable, eggs contain all the essential amino acids (the type that your pet's body cannot make from other substances) and very high levels of total amino acids - especially important sulfur-containing amino acids.

3. Creatine **20/100 grams.**

Creatine is an all natural, necessary compound in all animals.

Literally hundreds of studies have been done on Creatine, showing its effectiveness for increasing muscle energy, muscle power, muscle size, overall human and animal athletic performance and even enhancing certain other areas of health.

Creatine is a compound amino acid produced in the liver, that helps supply energy to cells all over the body, in particular the muscle cells. It is made out of three amino acids: arginine, glycine, and methionine.

Creatine is transported through the blood by an active transport system. It is then used by the brain and by muscles that have high energy demands, such as skeletal muscles. Around 95% of Creatine is stored in skeletal muscle.

Sir Haus Krebs won the Noble Prize in 1935 for discovering the chain of chemical reactions that convert all sources of fuel in the body to adenosine triphosphate (ATP), which is the primary energy compound for all living things, from human to cats and dogs, right down to single-celled algae. At the very core of human and animal functioning and chemistry, this is where Creatine works by increasing and improving ATP utilization and regeneration.

Once inside muscle cells, Creatine gets a high-energy phosphate attached to it and is then known as phosphocreatine (PCr) or Creatine phosphate. It is this high-energy molecule that is one of the most critical components of Creatine's beneficial effects in the body. That's because Creatine donates its high-energy phosphate to create ATP (adenosine triphosphate), which is used by the muscle for the rapid energy it needs for muscle contraction. Supplementing with Creatine is reported to increase the content of PCr in muscle. See Int J Sports Med. 2000 Feb;21(2):139-45. ***Effect of exogenous creatine supplementation on muscle PCr metabolism.*** Francaux M, Demeure R, Goudemant JF, Poortmans JR. Having more PCr in muscle cells means more ATP can be rapidly produced

during exercise, which can lead to gains in strength, power, speed and muscle growth.

Most commercial pet foods contain very little Creatine. See ***The concentration of creatine in meat, offal and commercial dog food.*** Department of Veterinary Basic Sciences, Royal Veterinary College, University of London, North Mymms.

'The concentrations of creatine (Cr), phosphorylcreatine (PCr) and creatinine (Cn) were determined in a variety of meats, before and after cooking by boiling, in a range of commercially available canned dog foods, in rendered and dried meat products and in commercially available dry dog foods. None of the samples contained PCr. Uncooked chicken, beef and rabbit meat contained approximately 30 mmol kg-1 of Cr. Ox-heart and ox-liver had Cr concentrations of 22.5 and 2.3 mmol kg-1, respectively. Canned dog foods had Cr concentrations of 0.5 to 2 mmol kg-1. Dried meat samples had Cr concentrations of 90 to 100 mmol kg-1 dry weight. In contrast, the Cr concentration of dried rendered meat meal was 3 mmol kg-1 dry weight or less. Dry dog foods contained 0.5 to 4 mmol kg-1 dry weight of Cr. The results indicate that in the canned dog foods, the dried meat samples and the dried rendered meat meal creatine had been degraded to variable extents to creatinine."

About 95% percent of Creatine in found in the skeletal muscles. In other words, in meat. An explanation for the virtual absence of Creatine from commercial pet foods could be the low amounts/quality of animal meat that is used, compounded by the processing of whatever amount/quality of the animal meat with high temperatures under high pressure.

See in this regard ***Effect of pressure processing on amino acid digestibility of meat and bone meal for poultry*.** Shirley RB1, Parsons CM.

"In the future, it may become desirable or required to process meat and bone meal (MBM) under pressure to reduce human health concerns associated with bovine spongiform encephalopathy (BSE). Therefore, three experiments evaluated the effects of different processing pressures on the digestibility of amino acids (AA) in MBM when the pressure processing was done after typical rendering (Experiments 1 and 2) or during the initial rendering process of raw materials (Experiment 3). Processing pressures varied from 0 to 60 psi in experimental or

commercial feather meal cookers. Increasing pressure during processing reduced MBM Cys concentrations in Experiments 1 and 2. True digestibilities of most AA were significantly decreased by increasing pressures in Experiments 1 and 2, and reductions were generally largest for Cys and Lys, particularly Cys, and increased with severity as pressure increased. For example, in Experiment 1, Cys digestibility decreased from 65 to 50 to 15%, and Lys digestibility decreased from 76 to 68 to 41% as the MBM was processed at 0, 30, and 60 psi, respectively, for 20 min. When the pressure processing occurred during the initial rendering of the MBM raw material (Experiment 3), a significant reduction in digestibility of most AA was observed only at 60 psi, and the decrease was much less than that observed in Experiments 1 and 2. Our results indicate that pressure processing of MBM decreases the digestibility of AA for poultry. Thus, pressure processing of MBM to reduce potential BSE infectivity will likely decrease the nutritional value of the MBM.

Creatine is one of, if not the most popular sports supplements in the world for mass gain. Surveys performed on creatine use in athletes indicate that creatine is used by over 40% of athletes in the National Collegiate Athletic Association (NCAA), and that athletes from about 20 different NCAA sports reportedly use creatine. Creatine use in power-sport athletes may be even more prevalent, with up to about 75% of powerlifters, boxers, weightlifters, and track and field athletes reportedly using the supplement. And a survey of gym/health club members conducted in 2000 reported that about 60% of members are creatine users."

Even though it is primarily stored in muscle tissue, Creatine enhances cellular energetics throughout the body. Creatine research also shows that it 1). Improves protein synthesis 2). decreases protein breakdown 3). improves health status in human of HIV patients 4). improves immune cell function 5). improves body composition 6). improves symptoms of diabetic 7). Prevents and treat ALS 8). prevents 9). Improves patients with Chronic Obstructive Pulmonary Disease (COPD) 10). enhances and repair damage to skin cells 11). treatments of cardiovascular disease 12). increases bone density 13). natural stimulation of I G F – 1 (insulin-like growth factor) 14. assists calcium to maintain proper muscle contraction and relaxation.

4. Taurine **07/100 grams**

Taurine is an amino sulfonic acid, which is found in raw animal and seafood meat tissue. It is highly water soluble and the relatively small amounts of taurine in the pre-processed commercial dog foods is materially degraded by the heat processing of virtually all commercial dog foods. Taurine is virtually absent for most commercial dog foods. Although Taurine can be synthesized by dogs, certain breeds appear to be more susceptible to Taurine deficiency, amongst others, American cocker spaniels and giant breed dogs like the Newfoundland. The ability to synthesize Taurine diminishes with age.

Taurine is generally associated with longevity. Amongst many other properties, it improves blood flow, it is an important indirect antioxidant, it appears to protect the skin after Ultra Violet sun damage and it improves bioavailability of the lipid soluble vitamins A, D, E, K, and F. Amino Acids. 2000;19(2):409-21.**Taurine as a universal carrier of lipid soluble vitamins: a hypothesis**. Petrosian AM1, Haroutounian JE.

"In the literature Taurine is characterized as a non-specific growth or blood clotting factor, an antioxidant, a membrane protector, or a regulator of calcium ion homeostasis, just as vitamins A, D, E, F, and K are similarly characterized. On the basis of recent finding concerning the relationship between taurine and the aldehyde of vitamin A-retinal (Petrosian and Haroutounian, 1988, 1998; Petrosian et al., 1996), as well as on the basis of data from the literature, we now suggest a hypothesis that taurine promotes the bioavailability of the lipid soluble vitamins A, D, E, K, and F, probably by forming different types of water soluble, easily hydrolysable complexes. It is quite possible that the ability of taurine to convert lipids and lipid soluble substances into a water soluble state is the key to understanding the unusually wide diversity of biological phenomena associated with Taurine. This form of delivery may be an additional, secondary mechanism for the transport of lipid soluble vitamins, which was probably acquired early in evolution, and remains extremely important for mammals and humans directly after birth for a variety of physiological functions such as: vision in normal and in emergency situations, rapid blood clotting, sperm eruption, and situations requiring a prompt consumption of lipid soluble vitamins characteristic of excitable

systems. Clearly, the role of taurine in the physiology of the water insoluble vitamins remains an enigma and is worthy of further investigations.”

5. Leucine **03/100 grams**

Leucine is one of nine essential amino acids in humans (provided by food).

Leucine is important for protein synthesis and many metabolic functions. Leucine contributes to regulation of blood-sugar levels, growth and repair of muscle and bone tissue, growth hormone production and wound healing. Leucine also prevents breakdown of muscle proteins after trauma or severe stress.

Leucine is one of three branched chain amino acids (BCAAs). Leucine appears to be the most potent of all amino acids in stimulating muscle protein synthesis. ***Leucine Supplementation Enhances Skeletal Muscle Recovery in Rats Following Exercise*.** Joshua C. Anthony, Tracy Gautsch Anthony, and Donald K. Layman.

Leucine activates the mTOR anabolic (muscle-building) signaling pathway. mTOR is sensitive to Leucine concentrations. Decreasing Leucine concentrations signal to mTOR that there is not enough dietary protein present to synthesize new skeletal muscle protein, so mTOR deactivates. In turn, increased Leucine levels signal to mTOR that there is sufficient dietary protein to synthesize new skeletal muscle protein and it activates. mTOR also increases the amount of protein that can be produced in period of time. Merrick, W. C., & Hershey, J. W. B. (2000) ***The pathway and mechanism of initiation of protein synthesis.***

6. **White Kidney Bean Extract 02/100 grams**

White kidney bean extract is specifically known as alpha-amylase inhibitor isoform 1. Alpha-amylase inhibitor isoform 1 (Alpha-AI1) is one of the main starch inhibitors alongside Alpha-AI2 and Alpha-AIL. Alpha-AI1 shows effective amylase binding abilities *in vivo* in mammals.

Via inhibition of Alpha-amylase, Alpha-AI1 prevents long chain carbohydrates from being taken up in the small intestine for nutritional value to the human. This causes starches to pass through to the colon where they have the potential to be fermented by bacteria. In this manner, Alpha-AI1 can make ingested carbohydrates act like a probiotic.

When fermented, these carbohydrates can release short-chain fatty acids including propionic acid, butyric acid, and acetic acid. These short chain fatty acids are thought to be involved in reducing the risk of colon cancer (as has been shown in experimentally induced animal models) as well as having other benefits, such as modulating insulin/glucagon release and acting as a low grade systemic Histone deacetylase(HDAC) inhibitor.

It has been noted in humans to effectively decrease amylase activity. Initially, studies in animals noted that raw bean consumption was able to ameliorate weight gain and later studies found that it could wholly be accounted for by a combination of reduced food intake and increased starch excretion suggesting that the mechanism of action in vivo is due to malabsorption and that in vitro studies carry over. Human studies measuring weight loss typically report a small, variable, but always present effect on nutrients absorbed during a meal and fat loss over time.

Scientific Support & Reference Citations

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- Layer P, Carlson GL, DiMagno EP ***Partially purified white bean amylase inhibitor reduces starch digestion in vitro and inactivates intraduodenal amylase in humans .*** Gastroenterology. (1985)
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- Udani J, Hardy M, Madsen DC ***Blocking carbohydrate absorption and weight loss: a clinical trial using Phase 2 brand proprietary fractionated white bean extract .*** Altern Med Rev. (2004)
- *A* ***Dietary Supplement Containing Standardized Phaseolus vulgaris Extract Influences Body Composition of Overweight Men and Women*** Leonardo Celleno, Maria Vittoria Tolaini, Alessandra D'Amore, Nicholas V. Perricone, Harry G. Preuss

7. **Aspergillus Niger Digestive Enzymes Blend** **02/100 grams**

The Aspergillus Niger Digestive Enzymes Blend is created by a fermentation process of the fungi Aspergillus Niger. It contains the following vital enzymes:

- **Protease** 4000 IU/mg

  Protease are any enzymes that starts (catalyse) the protein breakdown process (proteolysis) into amino acids by hydrolyzing the peptide bonds between the amino acids.

  Hydrolysis is a reaction involving the breaking of a bond in a molecule using water.

- **Lipase** 2000 IU/mg

  Lipase are enzymes that catalyse the hydrolyses of fats (lipids) into fatty acids and glycerol.

- **Amylase** 3500 IU/mg

  Amylase are enzymes that catalyses the hydrolyses of starch/complex carbohydrates into sugars.

- **Lactase** 2000 IU/mg

  Lactase is an enzyme that is essential in the breakdown of lactose (milk sugar).