



Understanding dog's nutritional requirements



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Nutrient Requirements

Nutrients	Details on the nutrients	
<i>Protein & Amino Acids</i>	Essential Amino Acids	
	Arginine	Arginine plays a critical role in the detoxification of ammonia, resulting from the turnover and breakdown of proteins. It is an important intermediate in the urea cycle which converts ammonia to urea. Puppies fed an arginine deficient diet containing adequate total protein will experience a decreased food intake and hyperammonemia resulting in vomiting and muscle tremors.
	Histidine	Histidine is present at high concentrations in haemoglobin; the positive charge on the imidazole side chain of this amino acid promotes oxygen exchange in the lungs and other tissues. Puppies and Adult Dogs fed a histidine deficient diet experienced weight loss, lethargy and food refusal after several a few days.
Isoleucine, Leucine and Valine	Isoleucine, leucine and valine are constituents of protein. Leucine also influences protein synthesis and muscle deposition by increasing plasma insulin secretion, sensitivity of insulin binding to muscle cells and inhibiting muscle catabolism. Puppies and Adult Dogs fed diets deficient in leucine, isoleucine or valine experienced decreased food intake and weight loss.	

<p><i>Protein & Amino Acids</i></p>	<p>Lysine</p>	<p>Lysine plays a key role in determining the secondary structure of proteins. It is a precursor of hydroxylysine, a key component of collagen, and of carnitine, which plays an important role in energy metabolism by transporting fatty acids into the mitochondria. Short-term feeding of a lysine deficient diet resulted in depressed food intake and weight loss in growing puppies. Excess Lysine in the dog's diet is linked to Arginine deficiency.</p>
	<p>Methionine and Cystine</p>	<p>Methionine is part of the coenzyme s-adenosylmethionine, which through its ability to transfer to and methylate other substrates, Cystine readily forms sulphide bonds with other thiol groups stabilizing secondary and tertiary structure in proteins such as hair, glutathione, and insulin. Puppies fed a methionine deficient diet experience decreased food intake, weight loss and evidence of dermatitis. Inadequate intake of sulphur amino acids without supplemental taurine has also been associated with development of taurine deficient cardiomyopathy, and pigmented gallstones in adult dogs.</p>
	<p>Phenylalanine and Tyrosine</p>	<p>Phenylalanine and tyrosine are incorporated into structural protein and the presence of the hydrophobic aromatic side-chain will induce a fold in the protein structure. In addition to being required for normal growth, both phenylalanine and tyrosine are further incorporated into key regulatory hormones and compounds. Puppies fed a phenylalanine deficient diet experience decreased food intake and weight loss. Adult dogs fed inadequate phenylalanine and tyrosine levels in the diet develop a reddening of the hair coat.</p>

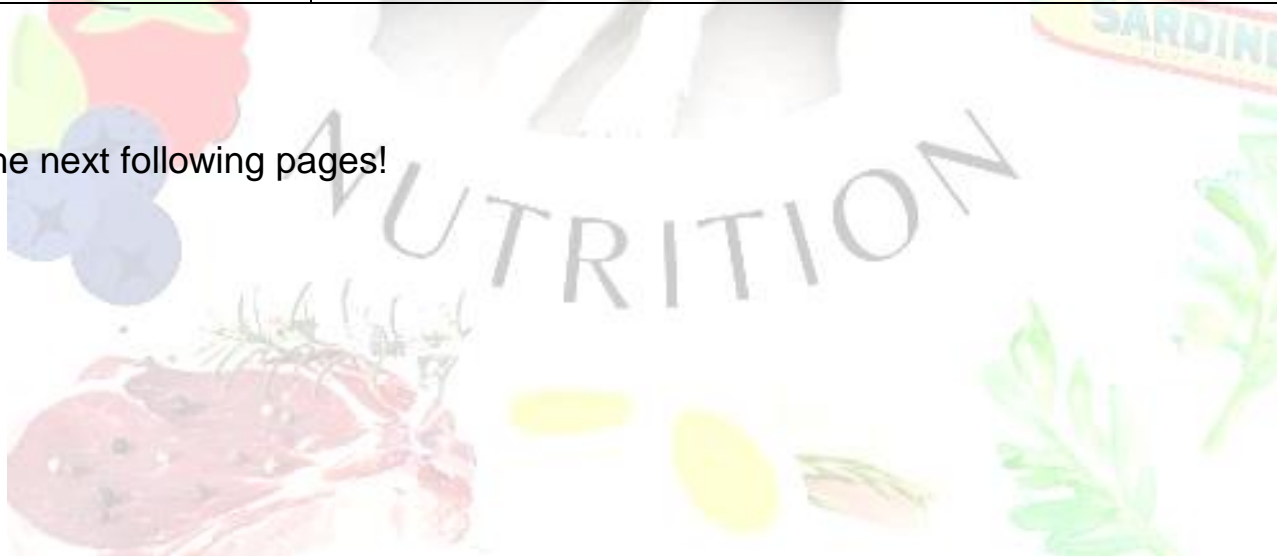
Protein & Amino Acids	Threonine	Threonine helps in phosphorylation / dephosphorylation of the threonine hydroxyl groups on proteins is by either serine/threonine kinase or serine/threonine phosphatase, respectively, and controls activity of normal physiologic function, such as insulin release or cellular apoptosis. Puppies fed a threonine-deficient diet experienced decreased food intake and weight loss.
	Tryptophan	Tryptophan is an essential amino acid for dogs and cats. NAD and NADP are formed during the degradation of tryptophan in both dogs and cats, though the major dietary precursor of NAD and NADP in both species is niacin. Tryptophan also influences the black coat colour in dogs.
	Non- Essential Amino Acids	
	Taurine	Taurine is not considered an essential dietary amino acid for dogs. Unlike cats, dogs are able to synthesize sufficient taurine when the sulfur amino acid precursors, methionine and/or cysteine, are present in adequate amounts in the diet. However, there are medical conditions such as Dilated Cardiomyopathy that increase the need for the amino acid taurine.
	Glutamic acid	Glutamic acid is not always needed but it is essential and proves beneficial in times of medical conditions such as leaky gut syndrome, IBD and pancreatitis. Dogs with chronic digestive distress are usually fed rich glutamic acid foods to aide a better digestive system.

Fats

Linoleic Acid (LA)	Linoleic acid (LA) is an omega-6 essential fatty acid that plays a physiological role in maintaining the water permeability barrier of the skin. Additionally, LA fatty acid is used to synthesize the EFA (Essential Fatty Acids) arachidonic acid. Linoleic acid (LA) is a fatty acid found in many nuts, seeds, oils, and animal fats. The primary source of LA fatty acids in a raw diet will be found in animal sources, especially in raw fats. The primary source of LA fatty acids in cooked diets are oils such as coconut oil, wheat germ oil etc.
Alpha- Linolenic Acid (ALA)	Alpha-Linolenic Acid (ALA) is an omega-3 essential fatty acid but it does not appear to have direct functions when feeding dogs because dogs cannot convert ALA fatty acids to EPA and DHA more efficiently, they are used to balance the fats between LA and ALA.
Arachidonic Acid	Arachidonic acid (AA) is an omega-6 essential fatty acid and it is primarily required for growing puppies rather than adult dogs. This fatty acid is used as a starting material in the synthesis of two kinds of essential substances, prostaglandins and leukotrienes.
Eicosapentaenoic acid (EPA) & Docosahexaenoic acid (DHA)	Eicosapentaenoic and docosahexaenoic acid (EPA/DHA) are omega-3 essential fatty acids. Eicosapentaenoic and docosahexaenoic acid (EPA/DHA) are often recommended in combined amounts and are highly concentrated in marine foods like fatty fish. Dogs specifically need EPA and DHA to decrease inflammation and aid better cognitive functions.

<i>Fiber</i>	Soluble Fiber	Soluble fibers dissolves in water and turns into a gel. This slows down the digestion process, which can help the dog feel full for a long time. Soluble fibers are also a fermentable energy source for gut microbes and a necessary part of a healthy gut. Excessive soluble fiber in the diet can lead to over fermentation, which can causes flatulence and loose stools.
	Foods rich in soluble fiber:	Oats, Beetroot, Broccoli, Sweet Potato, Bell peppers, and Psyllium husk.
	Insoluble Fiber	Insoluble fibers do not dissolve in water like soluble fiber, it helps to speed up digestion and bulks up the stools, which helps prevent constipation. Because insoluble fibers are not digested, they can also help in weight-loss diets to increase the weight of the food fed without increasing the caloric intake.
	Foods rich in insoluble fiber:	Brown Rice, Quinoa, Pumpkin, Cauliflower, Spinach, Cucumber, Apples w/Skin, and Ground Flaxseeds.

Vitamins in the next following pages!



Vitamins

Vitamin A (Retinol)	Vitamin A is a fat-soluble vitamin that is required for normal vision, growth, reproduction, immune function, and maintenance of healthy epithelial tissue functions. Excessive consumption of liver can lead to hypervitaminosis A and may produce skeletal lesions, including deforming cervical spondylosis, and large joints, osteoporosis, inhibited collagen synthesis in growth plates of growing dogs, and narrowed intervertebral foramina.
Vitamin D3	Vitamin D is actually a hormone that promotes calcium absorption. In humans it is produced in the skin in response to sunlight (UV) exposure. Dogs are unable to synthesize Vitamin D adequately in the skin. When fed a diet deficient in Vitamin D, puppies develop rickets. Vitamin D plays an indirect role in bone health by managing calcium levels in the body. It controls absorption of calcium in the intestine and the amount of calcium excreted by the kidneys. If Vitamin D levels are low, then the intestines struggle to absorb calcium.
Vitamin E	Vitamin E is a fat-soluble vitamin that functions as an antioxidant in the body and in food where it protects cells against oxidation and free radicals. Additionally, Vitamin E plays a vital role in reproduction, modulating cellular signaling, regulating gene transportation, modulating immune function, and inducing apoptosis.
Vitamin K	Vitamin K is required for normal blood clotting and is also involved in the regulation of calcium phosphates in growing bone. The synthesis of vitamin K by intestinal bacteria of dogs contributes significantly to the requirements of vitamin K for the species. Deficiency is usually due to intestinal malabsorption, as being a fat-soluble vitamin, these vitamins are generally low in cases of IBD or EPI.

<p>Thiamine (Vitamin B1)</p>	<p>Thiamine is a water-soluble vitamin required to metabolize carbohydrates into glucose for energy. Vitamin B1 also plays a key role in nerve, muscle, and heart health. Thiamine is found in a wide variety of foods, Animal tissues such as Pork, Chicken Heart contain the highest amounts of Vitamin B1. Thiamine deficiencies are linked to neurological disorders. Fishes containing thiaminase should be cooked prior feeding because thiaminase binds to thiamine and making it unavailable for the dog's body to absorb.</p>
<p>Riboflavin (Vitamin B2)</p>	<p>Riboflavin is a water-soluble vitamin required for coenzyme activity, energy production, cellular function, growth, and development. Vitamin B2 also plays an important role in the metabolism of fats and amino acids.</p>
<p>Niacin (Vitamin B3)</p>	<p>Niacin is a water-soluble vitamin required to convert carbohydrates into glucose to be used as energy, produce macromolecules (including fatty acids and cholesterol), facilitate DNA repair, and stress responses. Dogs have the ability to synthesize niacin from tryptophan. Therefore, the dietary requirement for niacin is dependent on tryptophan (amino acid) levels.</p>
<p>Pantothenic Acid (Vitamin B5)</p>	<p>Pantothenic acid is a water-soluble vitamin required for coenzyme and carrier protein synthesization. Vitamin B5 also plays an important role in the metabolism of proteins, carbohydrates, and fats. Pantothenic acid can be found in many different foods but is in higher concentrations in meat-based ingredients.</p>

<p>Pyridoxine (Vitamin B6)</p>	<p>Pyridoxine is a water-soluble vitamin and plays a vital role in the normal function of the nervous system, red blood cell formation, the immune system, and psychological functions. Pyridoxine is required for the conversion of tryptophan to niacin, Vitamin B6 requirements are influenced by the amount of protein in the diet.</p>
<p>Biotin (Vitamin B7)</p>	<p>Biotin is a water-soluble vitamin required to convert carbohydrates into glucose to be used as energy, produce amino acids and fatty acids, and the metabolism of proteins. Half of biotin requirements are created by gut microbes and the remaining requirements to meet RA are supplied by the diet. Many nutritional analysis reports do not include biotin levels. However, it is found in a wide variety of foods.</p>
<p>Folic Acid (Vitamin B9)</p>	<p>Folate plays a major role in DNA synthesization, the growth of cells, and the function of cells. Additionally, folate is required for amino acid metabolism, the formation of creatinine, and has a symbiotic relationship with Vitamin B12 to produce methionine from homocysteine.</p>
<p>Cobalamin (Vitamin B12)</p>	<p>Cobalamin plays a major role in brain and nerve function as well as the creation of DNA, RNA, and red blood cells. Cobalamin cannot be synthesized by the dogs body itself and has to be obtained by the diet. Dogs with medical conditions, such as Exocrine Pancreatic Insufficiency (EPI), Inflammatory bowel disease (IBD) due to malabsorption of the vitamin are at risk of vitamin B12 deficiency. Hence those dogs are supplemented with B12 tablets / capsules.</p>

Choline

Choline is synthesized in the liver with the presence of Vitamin B12 and folic acid. It helps the dog's brain to develop properly and ensure optimal liver health by protecting it from disorders like hepatic lipidosis. Choline also helps your dog maintain hydration by preventing the loss of water through the skin.

Vitamin C
(Ascorbic Acid)

Vitamin C is synthesised from glucose by plants and most animal species, including dogs. When present in foods, ascorbic acid is easily destroyed by oxidative processes. Exposure to heat, light, oxidative enzymes, and the minerals copper and iron all contribute to losses of vitamin C activity. Collagen is the predominant structural protein in animals and is a primary constituent of osteoid, dentine (tooth support), and connective tissue and so vitamin C is crucial to the health of all of these.

Minerals in the next following pages!

<i>Minerals</i>	<i>Macro-minerals</i>	Calcium	<p>Calcium is the main structural component of skeleton and teeth, but it also plays a role in blood clotting. In addition, it is involved in the intracellular messaging triggering the contraction of muscle fibres. Calcium also plays a role in fat oxidation and it carries ATP (energy) with magnesium.</p>
		Phosphorous	<p>Phosphorus is mainly used for the growth and repair of body tissues as it is a component part of bones, teeth, RNA and DNA. Phosphorous is also a component of cell membrane structure and of the body's key energy source, ATP. In cases of chronic kidney disease (CKD), dog's ability to excrete phosphorus becomes compromised.</p> <p>This is why low phosphorus diets are often recommended incase the dog is diagnosed with renal disease.</p>
		Potassium	<p>Potassium is also involved in energy production and membrane excitability and transport. Throughout the body there are a number of functions that are potassium dependent. Potassium helps nerves and muscles to function correctly, it maintains a regular heartbeat and helps nutrients move into cells and waste products out of cells. Pumpkin and Coconut water being a rich source of potassium is often recommended to feed in Diarrhoea, IBS, CKD cases.</p>

Magnesium

Magnesium helps promote the absorption and metabolism of other minerals such as calcium, phosphorus, sodium and potassium, It also plays a role in the utilisation of B-complex vitamins and vitamins C and E. Magnesium deficiencies have been linked with cardiovascular disorders, including high blood pressure and abnormal rhythms.

Sodium

Sodium is an essential nutrient involved in the maintenance of normal cellular homeostasis and in the regulation of fluid and electrolyte balance and blood pressure. Its role is crucial for maintaining extracellular fluid volume because of its important osmotic action and is equally important for the excitability of muscle and nerve cells and for the transport of nutrients and substrates through plasma membranes.

Chloride

Chloride is one of the most important electrolytes found in the blood. It plays a key role in controlling the amount of water and type of compounds that go in and out of cells. It therefore plays a crucial role in homeostasis. Chloride also contributes to muscle function and this includes the heart. This mineral helps red blood cells exchange oxygen and also supports digestive processes through its role in the production and release of hydrochloric acid in the stomach.

	<i>Micro-minerals</i>	Iron	Iron is present in body tissues as hemoglobin and myoglobin (The reddish liquid left after thawing meat). Iron is present in many enzyme and protein responses necessary for oxygen activation, oxygen transportation, and electron transportation.
		Copper	Copper has a number of functions throughout the body, starting from Energy production in mitochondria, Mobilisation and transfer of iron from storage sites to the bone marrow, Acts as an antioxidant, breaking down of serotonin, histamine, and dopamine and also in synthesis of collagen and elastin in connective tissue.
		Zinc	Zinc plays a major role in multiple physiologic functions such as nucleic acid metabolism, protein synthesis, carbohydrate metabolism, skin and wound healing, cell replication and differentiation, growth, reproduction, and hormone production. It is also essential for healthy skin, eye, and brain function. Long term Zinc Deficiency leads to chronic inflammation, skin & coat issues, reduced energy levels, and also a low immune system.
		Manganese	Manganese functions as a component in cell enzymes and can be found in the mitochondria of cells. Manganese plays a vital role in bone and cartilage development where it is necessary for joint health. It also acts as an antioxidant, assists in carbohydrate metabolism. Increasing manganese amounts in the diet is beneficial for pets who suffer from joint injuries and osteoarthritis.

Selenium

Selenium is a nutrient that plays a key role in maintaining thyroid hormone metabolism and DNA synthesis, it also protects against oxidative damage and infection. Selenium can be found in large amounts in the spleen, liver and lymph nodes. It has been showed to stimulate the antibody formation and the activity of the helper T cells along with the cytotoxic T and NK cells. Selenium also spares the vitamin E by preserving pancreatic integrity by allowing normal fat digestion which supports normal vitamin E absorption, reduces the amount of vitamin E required to maintain lipid integrity, and aids in vitamin E retention in blood plasma. Richest food sources of Selenium is Beef / Lamb Kidneys.

Iodine

An essential mineral, iodine is used by the thyroid gland to make thyroid hormones that control many functions in the body including growth and development. Iodine can only be obtained from diet or in supplemental form. Seaweed like kelp, wakame powder are rich in iodine, but other sources include poultry and seafood. Long term deficiency of iodine is linked to Dietary induced hypothyroidism.

Please go through our previous e-books for more information

www.linktr.ee/kaninenutrition

Make the change and see the difference

Help your dog to thrive; not survive!

Thank You!

Sources:

[https://en.wikivet.net/Veterinary Education Online](https://en.wikivet.net/Veterinary_Education_Online)