

Nutrients

Nutrients are substances obtained from food and used by an animal's body as either a source of energy or as part of its metabolic machinery to promote maintenance, growth and reproduction. There are six major nutrient groups: **water, protein, fats, carbohydrates, vitamins and minerals.**

Water is the most important nutrient. It is essential to life and is present in blood and lymph, inside cells, between cells, and accounts for between 60 to 70% of the body weight of an adult dog. A deficiency of water may have serious repercussions. A 15% loss can result in death.

Pets need to have good quality water available to help meet the needs of their bodies. Food may also help provide some of your pet's water need. A dry pet food may contain up to 10% moisture while a canned pet food may contain up to 85% moisture. Inadequate water intake may affect an animal's physical activity, reproduction, lactation, and growth.

Proteins in food are the basic building materials for cells, tissues, organs, enzymes, hormones and antibodies and are essential for growth, maintenance, reproduction and repair. Amino acids are the building blocks of proteins. Chains of amino acids link together to form proteins.

Amino acids are divided into two groups:

- Essential amino acids - These cannot be synthesized by the animal in sufficient quantities to meet the animal's needs and **MUST** be supplied in the diet. Essential amino acids include Arginine, Methionine, Histidine, Phenylalanine, Isoleucine, Threonine, Leucine, Tryptophan, Lysine, Valine, Taurine (cats only)
- Non-essential amino acids - These can be synthesized by the animal, so are not needed in the diet.

Taurine is an essential nutrient for the cat because, unlike dogs, cats cannot synthesize enough taurine to meet their needs. In humans and dogs, taurine can be produced from the essential amino acid methionine and cysteine. Cats lack the enzyme for this reaction, so taurine must be obtained from the food. Taurine is only found in foods of animal origin, such as meat, eggs and fish. Grains and vegetables do not contain taurine. Taurine is required for the prevention of eye and heart disease, as well as reproduction, fetal growth and survival.

Proteins can be obtained from a number of sources:

- Meat can be high quality, but this will depend on the cut, source and type of meat. Animal-based proteins such as chicken, lamb, turkey, beef and egg have complete amino acid profiles.
- Fish is a very good protein source.
- Egg is regarded as the quality standard for protein sources. It has a high BV, often given as 100, but the true value is about 98. (However, raw egg white contains avidin, an anti-vitamin, which ties up or binds biotin from egg yolk. Eggs should therefore be cooked before they are fed to animals.)
- Vegetable/cereal protein quality will vary with the type, age and conditions under which the plant was grown. Generally, vegetable and cereal proteins are deficient in some essential amino acids. Cereal grains also contain starch, and poorly processed starch can depress the digestion of the proteins in the diet decreasing the efficiency of the proteins.
- Soy is often used as a protein source. It is an incomplete protein. Improperly processed soy contains an enzyme inhibitor that prevents proper protein digestion. Soy also contains phytates that can bind calcium, phosphorous and zinc and contains large

amounts of non-absorbable oligosaccharides that may be fermented by intestinal bacteria leading to gas production and flatulence.

Fats include both oils and fats and may be called "lipids." Oils are liquids at room temperature while fats are solid.

Functions of Fats:

- The most concentrated form of food energy providing more than twice the energy of proteins or carbohydrates. Fats can also be stored so they are an important form of stored energy.
- Essential in the structure of cells and for the production of some hormones.
- Required for absorption and utilization of fat soluble vitamins.
- Insulation and protection under skin and around internal organs.
- Important in inflammation.

Essential fatty acids must be provided in the diet because they cannot be synthesized by the dog or cat in sufficient amounts to meet their needs. A deficiency of essential fatty acids may result in reduced growth or increased skin problems.

Linoleic acid is an essential fatty acid for both cats and dogs while arachidonic acid is an essential fatty acid for cats only. Dogs, like humans, can convert linoleic acid into arachidonic acid. Cats do not have enough of the enzyme needed for this step. Therefore, cats require both linoleic and arachidonic acid in their diets. Arachidonic acid is important for the maintenance of the skin and coat, for kidney function and for reproduction.

Omega-6 and omega-3 fatty acids play a vital role in inflammation. As the omega-6 fatty acid content of the diet increases, more omega-6 fatty acids are built into the cell walls resulting in a greater inflammatory reaction when the cell is damaged. Replacing some omega-6 with omega-3 fatty acids can lessen the inflammatory reaction. This appears to be true regardless of whether the inflammation is in the skin (from allergies), the joints (from arthritis), the intestines (from inflammatory bowel disease) or even in the kidney (from progressive renal failure). The optimal ratio of omega-6 to omega-3 fatty acids for dogs is between 5 and 10 to 1.

It is impossible to accurately determine the fatty acid ratio of a diet if the owner prepares home-cooked foods. Obtaining an accurate ratio by supplementing homemade or other commercial diets with omega-3 capsules is also unlikely; the ratio of fatty acids in the base diet is not known and may vary from batch to batch. If a dog is to benefit from the effects of these fatty acid ratios, they must be fed a fixed-formula food that guarantees these ratios.

Carbohydrates and Fiber are what evolving carnivores derived most as intake as semi-digested material from the gut of their prey. There is, as yet, no accepted minimum dietary carbohydrate requirement for dogs and cats, but studies have demonstrated recently that carbohydrates and fiber play a vital role in the health of the intestine and are likely to be important for reproduction. Carbohydrates are made of carbon (C), hydrogen (H) and oxygen (O) and include sugars (e.g. glucose, fructose and sucrose), starches and fiber.

Functions of Carbohydrates and Fiber:

- Energy - Carbohydrates in the diet provide a source of energy.
- Provide bulk (fiber) for peristalsis (muscular contractions of the gastrointestinal tract which results in the movement of food material through the gut).
- Provides short chain fatty acids (from bacterial fermentation of fiber) for use by intestinal cells for healthy gut formation.

- Certain fibers modify the mix of the bacterial population in the small intestine, helping to manage chronic diarrheas.

Dietary Fiber Fermentation: For dogs and cats to obtain the most benefit from fiber, the fiber source must be moderately fermentable. Fiber sources that have low fermentability (e.g. cellulose) do not provide sufficient short chain fatty acids (SCFAs) for the intestinal cells, resulting in poor development and less surface area of the intestinal mucosa. Highly fermentable fibers (e.g. guar gum) provide plenty of SCFAs but also produce gases and by-products that can lead to flatulence and excess mucus being produced. Moderately fermentable fibers (e.g. beet pulp) are best, as they provide just enough SCFAs to promote a healthy gut while avoiding the undesirable side effects.

Vitamins are catalysts for enzyme reactions. They facilitate reactions but are not part of the reaction themselves. Tiny amounts of vitamins are essential to dogs and cats for normal metabolic functioning. Vitamins are neither used as building blocks nor can they be broken down for energy. Most vitamins cannot be synthesized in the body and are therefore essential in the diet. Vitamins are classified as fat soluble or water soluble.

Due to the practice of supplementation, hypervitaminosis (poisoning due to excess vitamins) is more common than hypovitaminosis (vitamin deficiencies). When feeding a complete and balanced diet, it is unnecessary to supplement unless a specific vitamin deficiency is diagnosed by a veterinarian. Excess water soluble vitamins are excreted via the urine. Fat soluble vitamins are stored and, therefore, are potentially toxic. Excess vitamin A may result in bone and joint pain, brittle bones and dry skin. Excess vitamin D may result in very dense bones, soft tissue calcification or joint calcification.

Minerals are inorganic compounds which are not metabolized and yield no energy. These nutrients cannot be synthesized by animals and must be provided in the diet. In general, minerals are most important as structural constituents of bones and teeth, for maintaining fluid balance and for their involvement in many metabolic reactions. Minerals required in relatively large amounts are called macro-minerals. Those needed in small quantities are called micro-minerals or trace minerals. With commercial foods, true deficiencies are extremely rare, but imbalances may occur if the food is supplemented.