Comparative Analysis of Nutritional Differences in Feline and Canine Diets: Insights into Pet Food Formulation

We know cats and dogs have distinct characteristics. But have you ever pondered how your pet's food may be affected by internal metabolic differences?

Since cats and dogs have long been connected to humans, they are likely the two most well-liked companion animals in contemporary culture. In Europe in 1992, there were about 38 million dogs and 40 million cats, which accounted for 18 and 21% of all homes, respectively. The dietary needs of both species have been thoroughly investigated only in the last 20 years, despite their widespread appeal.

Classification

In terms of zoological classification, the order Carnivore includes both dogs and cats. Nonetheless, the idea that cat has undergone specialisation in line with the evolutionary influence of a strict carnivorous diet is supported by a comparison of the dietary needs of cats and dogs. While wild cats exclusively consume animals (small antelopes, rodents, birds, fish), the progenitors of dogs are known to have eaten vegetables (berries, apples, pears), fish, birds, and amphibians.

The dietary needs of cats are distinctively different from those of dogs due to several unique biological traits. These differences are highlighted as follows:

Cats have a limited ability to regulate enzymes responsible for breaking down amino acids. This results in a necessity for higher dietary protein levels for maintenance compared to dogs.

Unlike dogs, cats have a diminished capacity to produce the sulfur-containing amino acid, taurine, and cannot use glycine to conjugate bile acids. Consequently, cats need dietary sources of taurine since they can't rely on sulfur-containing amino acids in their diet to meet taurine needs.

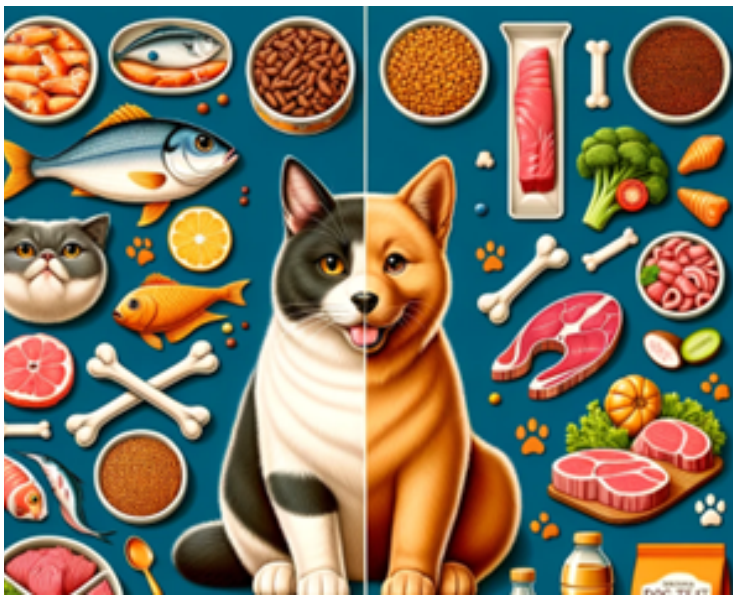
Cats are inefficient at converting tryptophan to nicotinic acid due to elevated activity of a-picolinic acid decarboxylase, leading to glutamate as the end product instead of nicotinic acid. This makes them unable to produce enough nicotinic acid on their own.

Cats lack the ability to turn carotene into retinol, meaning they cannot meet their vitamin A requirements through a plant-based diet alone.

Cats are unable to adequately convert linoleic acid to arachidonic acid, a necessary fatty acid.

High carbohydrate diets are not well-tolerated by cats, which seem to be in a continuous state of producing glucose from proteins and fats, irrespective of carbohydrate intake.

These specific nutritional requirements underscore the cat's status as an obligate carnivore, relying on a diet containing animal-derived materials.[2]



Apart from water, there are five essential nutrients:

1. Fats
2. Vitamins
3. Minerals
4. Carbohydrates
5. Minerals

Total Protein Requirement

The cat needs more protein than the majority of other mammals, including dogs. The cat has a larger requirement for protein overall, regardless of the amount of essential amino acids present, rather than an increased requirement for essential amino acids. The elevated activity of the N-catabolizing enzymes appears to be the metabolic cause. Alanine aminotransferase and glutamate dehydrogenase catalytic activity is much higher in cats than that of dogs.

Difference in Amino Acid Requirements

Amino Acid (mg/MJ diet)	Kitten	Puppy
Tryptophan	287	251
Threonine	335	304
Valine	287	251
Histidine	144	117
Lysine	383	335
Arginine	478	327
Isoleucine	239	324
Leucine	574	380

Source: Differences between cats and dogs: a nutritional view [3]

Dogs, when fed a diet with perfectly balanced and fully digestible protein, allocate 12 percent of that protein towards growth metabolism and just 4 percent for maintenance needs. Simplifying this, dogs require less protein in their diets compared to cats.

Arginine

We have seen that cat has high needs for protein overall, but its needs for some specific amino acids are especially noteworthy. On an arginine-free diet, hyperammonaemia manifests in both dogs and cats. But in cats, arginine deprivation is more severe because even one meal devoid of arginine causes serious problems that manifest two to five hours later.

Dogs are relatively unaffected by low arginine levels in their diets because they can internally produce enzymes that help synthesize arginine.

Taurine and Sulphur containing Amino Acids

Cats require higher levels of cysteine and methionine (AAFCO, 2021) in their diet than do most other mammals. Sulfur-containing amino acids (SAA) play a crucial role in producing Felinine, a compound all cats excrete, believed to be a significant component of the scent in urine that intact males use for marking territory. In contrast, castrated males and intact females predominantly excrete a metabolite of Felinine. Additionally, the typically dense fur of cats and their evolutionary adaptation to digesting food high in fat content are also thought to contribute to the cat's heightened dietary need for SAAs (Case 2011).[3] The specific significance of taurine in cat's nutrition was found less than 20 years ago when a taurine deficit in cats was linked directly to central retinal degradation. Unlike dogs, cats lack cysteine sulphinate decarboxylase and cysteine dioxygenase, which prevents them from synthesising taurine to meet their demands.

Dogs possess the ability to internally produce certain chemicals on their own.

Carbohydrates

The three primary types of carbohydrates found in food are starch, sucrose, and lactose; however, cats and dogs typically consume less lactose and sucrose. Dogs and cats have different metabolic processes for carbohydrates since cats seem to always be doing gluconeogenesis. Although the amount of hexokinase in liver of cats is comparable to that of other omnivorous mammals, there is less glucokinase activity, which may indicate that cats cannot tolerate diets high in carbohydrates.

Vitamin A

It is accurate to say that only retinol, retinaldehyde, and retinoic acid are referred to as vitamins A. Intestinal carotene dioxygenase is one of most important enzymes which transforms, beta-carotene into retinaldehyde having maximum vitamin A activity. This enzyme is almost undetectable in intestinal mucosa of cats and hence, cats are solely dependent upon the food from animal origin that has preformed vitamin A. (Green et al., 2011).5

Dogs possess enzymes within their intestinal lining capable of breaking down plant carotenoids, transforming them into active Vitamin A.

Vitamin B3

Vitamin B3 (niacin) is crucial for the metabolism of fats, carbohydrates, and proteins and is abundantly found in meat (Case 2011).3 Unlike dogs, cats cannot make niacin from the amino acid tryptophan and must get it directly from their diet. According to AAFCO nutrition guidelines, cats require nearly six times more dietary niacin than dogs.

Special Formulation Needed

Understanding the basics of nutrient metabolism is crucial for proper feeding and food production for cats and dogs. In practice, food derived from animals offers the correct ratios and amounts of all essential amino acids, as well as a wealth of functional nutrients like taurine, 4-hydroxyproline, creatine, and carnosine, in addition to fats and minerals. Feather meal, for instance, is utilized in both dry and wet pet foods to fulfill the significant needs cats and dogs have for arginine and taurine. Ingredients from animal sources, whether used alone or in combination, provide a rich supply of essential amino acids and taurine, supporting the optimal growth, development, health, and well-being of cats and dogs. The minimal nutrient levels needed for a full and balanced diet are present in Association of American Feed Control Officials (AAFCO) nutrient profile of dogs and cats. Hence there is necessity for cat food manufacturers to create healthy feed formulations satisfying the dietary requirements of cat in all stages of its life. Thereby, with responsible feeding and veterinary attention, you can ensure that your cat has a healthy and longer life span. 1

Recommended allowances of dietary Amino Acids for post-weaning growing dogs and cats, as well as adults

Nutrient	Dogs	Cats
Water, g/kg milk	773	790
Dry matter, g/kg milk	227	210
Crude protein, g/kg milk	75	75
Total amino acids, g/L milk		
Ala	2.5	2.80 ± 0.5
Arg	2.93	4.85 ± 0.5
Asp + Asn	9.53	6.51 ± 2.0
Cys	2.48	0.91 ± 0.5
Glu + Gln	8.9	15.8 ± 0.5
Gly	1.56	0.76 ± 0.5
His	1.35	2.04 ± 0.5
4-Hydroxyproline	NIL	NIL
Ile	1.97	3.26 ± 0.5
Leu	5.48	8.93 ± 0.5
Lys	3.17	4.32 ± 0.5
Met	1.41	2.42 ± 0.5
Phe	3.53	2.27 ± 0.5
Pro	3.62	7.12 ± 1.0
Ser	3.26	3.33 ± 0.5
Thr	3.44	3.48 ± 0.5
Trp	0.26	NIL
Tyr	3.57	3.41 ± 0.5
Val	3.8	3.56 ± 0.5
Taurine	0.33 ± 0.14	0.36 ± 0.04

Source: Amino acid nutrition and metabolism in domestic cats and dogs [4]

More advice can be found at www.foodresearchlab.com

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